The Phytochemical Analysis of *Centaurea ptosimopappa* Hayek with the Antioxidant and Enzyme Inhibitory Effects

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ABSTRACT

The phytochemical profiling, free radical scavenging, iron chelating, acetylcholinesterase and butyrylcholinesterase, tyrosinase, elastase and collagenase inhibition activities were determined on the methanol extract obtained from aerial parts of *Centaurea ptosimopappa*. GC-MS analysis of the extract revealed the presence of ursolic acid, oleanolic acid, suginal, α-amyrin, lupeol and 3-aceyl lupeol as the main constituents. In addition, the main phenolic acids (quinic acid 6.009 mg analyte/g, protocatechuic acid 0.070 mg analyte/g, chlorogenic acid 0.230 mg analyte/g) and flavonoids were found by LC-MS/MS analysis. The extract showed moderate antioxidant (DPPH IC_{50}: 3.48 mg/mL; ABTS IC_{50}: 0.462 mg/mL; Iron chelating IC_{50}: 1.02 ± 0.53 mg/mL) and anti-BChE (43.48 ± 2.88%) activity and weak enzyme inhibition activity against AChE, tyrosinase, elastase, and collagenase. These findings suggest potential applications in natural antioxidant or anti-aging formulations.

Keywords: *Centaurea*; Phenolic compounds; Antiaging; Alzheimer's.

INTRODUCTION

The Asteraceae (Compositae) family is the largest flowering plant family, comprising 24,000–30,000 species within 1600–1700 genus [1-3]. The genus *Centaurea* includes 400–700 species, making it one of the largest genera in the family [4-12]. *Centaurea ptosimopappa* is a perennial subshrub, growing up to 1.80 meters with ascending, glabrous branches, firm and leathery lanceolate–spatulate leaves and yellow flowers. This species is endemic to the Amanus Mountains of Hatay, southern Turkey, and the forest areas of North Lattakia, northern Syria, and is classified as Near Threatened (NT) in both Turkey and Syria, as well as globally [13].

Studies have demonstrated that extracts of various *Centaurea* taxa possess a wide range of biological effects, including antifungal, antiprotozoal, antimicrobial, antioxidant, antiplasmodial, anti-ulcerogenic, antiviral, and cytotoxic activities [14-34]. *Centaurea* species are known to contain diverse natural compounds such as flavonoids, lignans, phenolic compounds, sesquiterpene lactones, and steroids, which contribute to their biological activities [35-37]. Previous research on *C. ptosimopappa* has identified antimicrobial activity in different extracts and isolated compounds, showing effectiveness against some bacteria and yeasts [22].

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Received: 1/10/2024 Accepted: 24/4/2025.
DOI: https://doi.org/10.35516/jjps.v19i3.3471

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Antioxidants play a crucial role in protecting the human body from free radical damage. Due to the carcinogenic effects of some synthetic antioxidants, there is a focus on identifying naturally occurring antioxidants [23-24]. *C. ptosimopappa*s is considered a potential source of natural antioxidants, which may aid in the prevention and treatment of diseases linked to oxidative stress [19].

Various natural sources have also provided acetylcholinesterase (AChE) and butyrylcholinesterase (BuChE) inhibitors, which are promising candidates for Alzheimer's disease treatment due to their complex nitrogen-containing structures [38]. *Centaurea* species are widely used in herbal medicine, cosmetology, and the food industry. They are also employed as dyes in cosmeceuticals and other industries, as well as in gastronomy [21].

The present study aims to quantitatively evaluate the main bioactive compounds in the methanol extract of *C. ptosimopappa*, such as phenolic acids, flavonoids, and their glycosides. Total phenolic content (TPC) and total flavonoid content (TFC) were determined, and the antioxidant and enzyme inhibitory properties of the extract were assessed. Antioxidant activity was evaluated using DPPH and ABTS assays, while inhibitory activity was tested on various enzymes, including acetylcholinesterase, butyrylcholinesterase, tyrosinase, elastase, and collagenase.

MATERIAL AND METHODS

Plant material

The aerial parts of *Centaurea ptosimopappa were* collected in Hatay province of Turkey in January 2020 and identified by Mehmet Bona, Department of Science, University of İstanbul. The plant specimens were deposited in the Herbarium of the Faculty of Pharmacy at Ankara University under the Herbarium code of AEF 29960. Before extraction, the aerial parts were shade-dried and finely powdered.

Preparation of extract

The powdered material (90g) was extracted with methanol (400ml) at room temperature for 3 times for 8 hours each, and the extracts were evaporated by rotary evaporator (Buchi R-100, Swiss) at 40°C under vacuum. After filtration and solvent evaporation, the yield of the methanol extract of *C. ptosimopappa* was 22 % (g/g).

Total phenolic (TPC) and flavonoid content (TFC)

The TPC and TFC of the extracts were determined as previously described [39-40]. Gallic acid (GAE) for phenolics and quercetin (QE) for flavonoids were employed as standards to explain the findings.

Antioxidant activities

The antioxidant potential of the methanol extract of *C. ptosimopappa* was tested using a antiradical (DPPH and ABTS) assays [41]. BHT (Butylated hydroxytoluene) and α-tocopherol were the reference molecules for the DPPH and ABTS assays, respectively. All tests were conducted in triplicate and results are expressed as Mean ± standard deviation.

Enzyme Inhibitory Properties

The key enzyme inhibition activity of extracts against acetylcholinesterase (AChE, EC3.1.1.7), butyrylcholinesterase (BuChE, EC 3.1.1.8), tyrosinase (1.14.18.1), elastase (EC 3.4.21.37), and collagenase (EC 3.4.24.3) was measured using the protocols published previously.

Acetylcholinesterase (AChE) and Butyrylcholinesterase (BuChE) Inhibition Assay: The reaction mixture consisted of 50 µL of 100 mM sodium phosphate buffer (pH 7.4), 25 µL of AChE or BuChE enzyme solution (0.03 U/mL), and 125 µL of varying concentrations of extract or inhibitor. The mixture was incubated at 25°C for 15 minutes, followed by the addition of 50 µL of 1 mM acetylthiocholine iodide or 1 mM butyrylthiocholine iodide used as the substrate. The reaction was allowed to proceed for 30 minutes, and the absorbance was measured at 412 nm [41].

Tyrosinase Inhibition Assay: The reaction mixture

contained 80 µL of 0.1 M phosphate buffer (pH 6.8), 40 µL of tyrosinase enzyme solution (46 U/mL), 40 µL of varying concentrations of extracts or inhibitors, and 40 µL of 2.5 mM L-DOPA. The mixture was incubated at 37°C for 30 minutes, and the absorbance was measured at 475 nm [42].

Elastase Inhibition Assay: The reaction mixture comprised 100 µL of 0.1 M Tris-HCl buffer (pH 8.0), 50 µL of elastase enzyme solution (0.03 U/mL), and 50 µL of varying concentrations of extract or inhibitor. The mixture was incubated at 25°C for 20 minutes, followed by the addition of 100 µL of 0.8 mM N-Succinyl-Ala-Ala-Ala-p-nitroanilide (AAAPVN) as the substrate. The reaction was allowed to proceed for 30 minutes, and the absorbance was measured at 410 nm [43].

Collagenase Inhibition Assay: The assay mixture included 100 µL of 0.1 M Tris-HCl buffer (pH 7.4), 25 µL of collagenase enzyme solution (0.03 U/mL), 25 µL of varying concentrations of extracts or inhibitors, and 100 µL of 0.4 mM substrate N-[3-(2-furyl) acryloyl]-Leu-Gly-Pro-Ala (FALGPA). The mixture was incubated at 25°C for 30 minutes, and the absorbance was measured at 345 nm [44]. Inhibition was determined by comparing the absorbance with the control.

For all assays, controls (without extract), negative controls (without enzyme) and positive controls (standard inhibitors such as galanthamine for AChE and BuChE, kojic acid for tyrosinase, oleanolic acid for elastase, and epicatechin gallate for collagenase activity) were included. Negative controls were performed to confirm the baseline enzyme activity. The IC_{50} values (the concentration of the extract required for 50% inhibition) are calculated using non-linear regression analysis. All experiments were conducted in triplicate, and results are expressed as the mean ± standard deviation of mg standard equivalent per gram of dry extract.

GC conditions for determination of di- and triterpenoid contents

The sample was derivatized (120 min at 70°C) with *N,O*-bis (trimethylsilyl) trifluoroacetamide (BSTFA) containing 1% trimethylchlorosilane and analyzed using a 7890A Model GC/FID with 5977B MS to determine triterpene concentration. A nonpolar HP-5MS column (30 m × 0.25 mm × 0.25 µm film) was used for chromatographic separation. The GC oven was preheated to 200°C, then quickly increased to 300°C/min and held for 15 minutes. Then the temperature was raised to 310°C at a rate of 5°C/min 2 minutes before stabilizing. As the carrier gas, fixed helium gas (0.8 mL/min) was filled. The injection and transfer line temperatures both were set to 300°C. Splitless injections were carried out. The injection volume was 2.0 µL. The ionization energy of the electron ionization/mass spectrometer (EI/MS) was adjusted at 70 eV. The temperature of the ion source was set 230°C. Setting of the full scan mode and scan *m/z* to a density of 50-650 atomic mass units (amu) yielded MS data [45]. Using the same technology, the di-terpenoid content of the extract was also determined. For quantitative measurement of terpenoid content, two or three high-intensity fragment ions were utilized. GC-MS analyses were carried out using helium as the carrier gas on a nonpolar HP-5MS UI column (30m×0.25mm×0.25 µm film thickness) [45].

LC-MS/MS analyses of extract

The working solution of *C. ptosimopappa* methanol extract used for LC-MS/MS analyses (Shimadzu 8040 model) was prepared from the 4000 µg/mL of stock solutions by diluting according to the studied method. Using the developed and validated LC-MS/MS method previously by our research group, ten phenolic and flavonoid derivative chemical components were identified in the *C. ptosimopappa* methanol extract [46].

Statistical analysis

All quantitative analyses were done in triplicate (n = 3), and findings were reported as means ± standard deviation (Mean ± SD). Three replicates were used to determine bioactivities. The statistical analysis was performed using GraphPad Prism software (version 9.0.0). Analysis of variance (ANOVA) was used to

determine whether there were significant differences between the extracts, with a probability value of 5%.

RESULTS

Phytochemical Composition

In the present study, we evaluated the phytochemical composition of the methanol extract obtained from *C. ptosimopappa* with GC-MS/FID systems. The major terpenoid-steroid compounds of the methanol extract were presented as suginal, α-amyrin, lupeol and 3-acetyl lupeol. Ursolic acid was the most abundant triterpenoid compound (2060.48 µg analyte/g extract), it followed by oleanolic acid (1378.5 µg analyte/g extract) and α-amyrin (487.45 µg analyte/g extract) (see Table 1 and Figure 1).

Table 1. Terpenoid-steroid content of methanol extract of *C. ptosimopappa* by GC-MS

Compound	RT[a]	Molecular ion-m/z (relative intensity %) (m/z)[b]	Three major fragment ions m/z (relative intensity %)			(µg analyte/g extract)
						C. ptosimopappa
Suginal	19.728	314.43 (2.8)	299(100)	300(20.8)	281(4)	3972,09
α-Amyrin	31.944	426.73 (8.4)	218(100)	189(21.6)	203(21.2)	1132,70
Lupeol	31.944	426.38 (38.9)	218(463.5)	189(100)	203(98.2)	1071,41
3-Acetyl lupeol	33.513	468.40 (22.35)	189(100)	121(71.4)	203(35.1)	1167,37

[a]RT: Retention time; [b]Mother ion(m/z): Molecular ions of the standard compounds (m/z ratio)

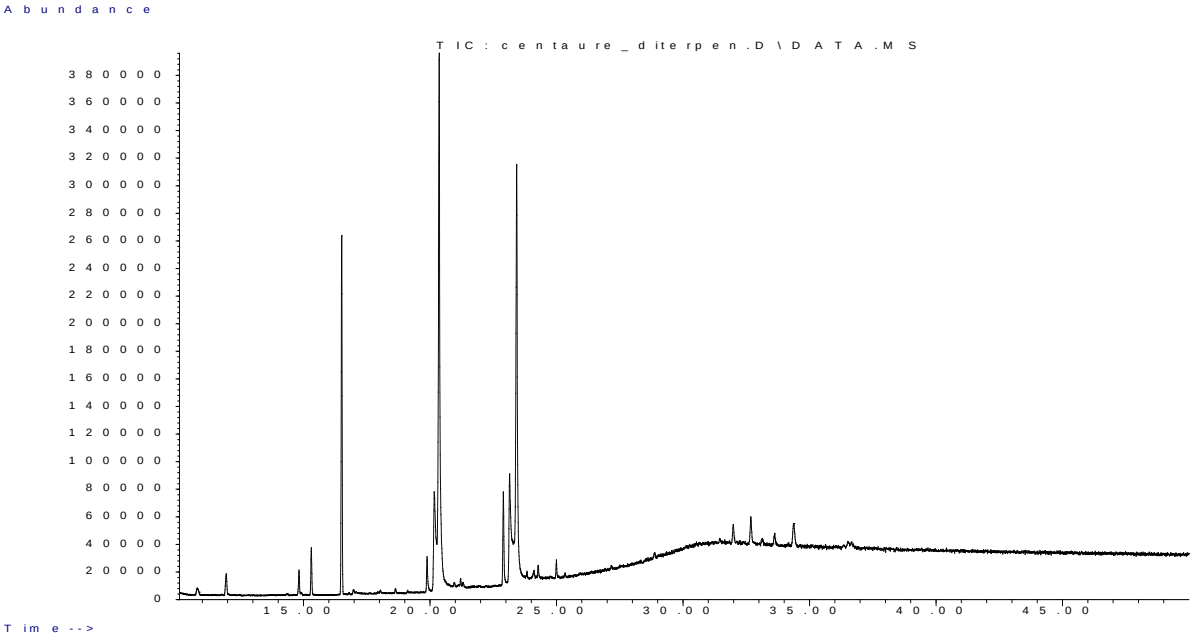


Figure 1. GC-MS Chromatogram of *C. ptosimopappa* Methanol Extract Highlighting Diterpene Compounds

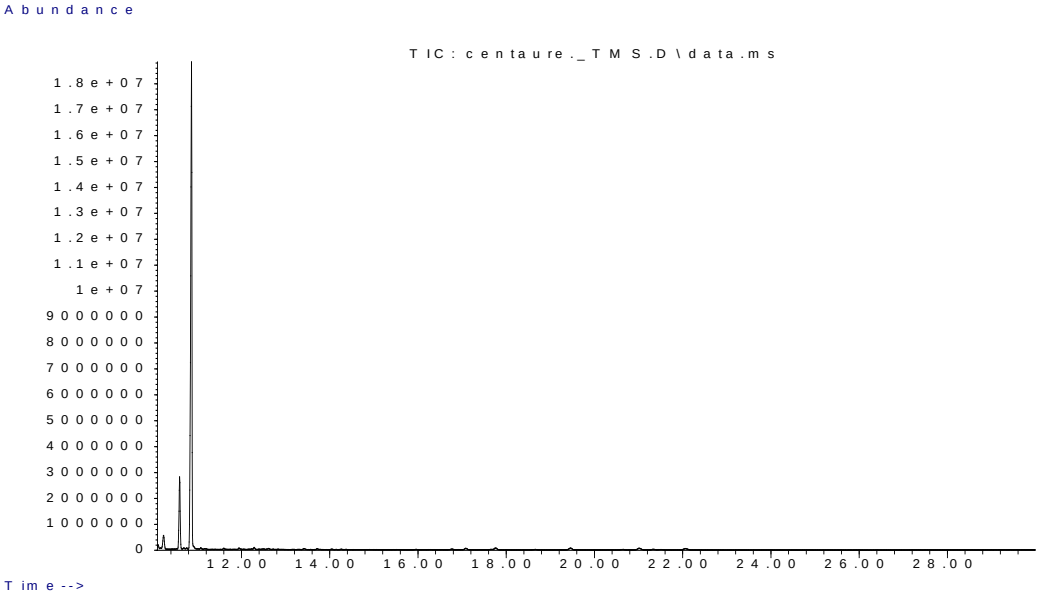


Figure 2. GC-MS Chromatogram of C. ptosimopappa Methanol Extract Highlighting Triterpene Compounds

Phenolic acids, flavonoids and their glycosides were determined in methanol extract of *C. ptosimopappa* using LC-MS/MS analysis were given in Table 2. The components are as follows: quinic acid (6.009 mg analyte/g), protocatechuic acid (0.070 mg analyte/g), chlorogenic acid (0.230 mg analyte/g), cymaroside (0.098 mg analyte/g), isoquercetrin (0.042 mg analyte/g), hesperidin (0.030 mg analyte/g), genistin (0.049 mg analyte/g), cosmosiin (0.011 mg analyte/g), luteolin (0.002 mg analyte/g) and acacetin (6.009 mg analyte/g) presented highest amount.

Table 2. Identification and quantification of compounds of *C. ptosimopappa* by LC-MS/MS

Analytes	Retention time (min)	Parent Ion (m/z)[a]	MS^2 (Collision Energy)[b]	Quantification (mg analyte/g extract)[c]
Quinic acid	3.0	190.8	93.0	6.009
Protocatechuic acid	6.8	152.8	108.0	0.070
Chlorogenic acid	8.4	353.0	85.0	0.230
Ferulic acid	18.8	196.2	152.1	IS[d]
Cynaroside	23.7	447.0	284.0	0.098
Rutin	25.5	612.2	304.1	IS
isoquercitrin	25.6	463.0	271.0	0.042
Hesperidin	25.8	611.2	449.0	0.030
Genistin	26.3	431.0	239.0	0.049
Cosmosiin	28.2	431.0	269.0	0.011
Quercetin	35.6	304.0	275.9	IS
Luteolin	36.7	284.8	151.0/175.0	0.002
Acacetin	40.7	283.0	239.0	0.006

[a]Parent ion (*m/z):* Molecular ions of the standard compounds (mass to charge ratio), [b]MS^2(CE): MRM fragments for the related molecular ions (CE refers to related collision energies of the fragment ions), [c]Values in *m*g/g (w/w) of plant ethanol extract, [d]IS: Internal standard

In this study, TFC and TPC of methanol extract of *C. ptosimopappa* were detected by $AlCI_3$ and Folin-Ciocalteu methods, respectively. As shown in Table 3, the TPC in 17.61 ± 0.44 µg of GAE/mg dry extract and the TFC 2.18 ± 0.01µg QE/mg dry extract.

Antioxidant Activity

A significant antioxidant activity is indicated by a low IC_{50} value. The present assay shows moderate DPPH and ABTS free radicals scavenging activity with the IC_{50} value of 3.48 mg/mL and 0.462 mg/mL by methanol extract of *C. ptosimopappa*, respectively in comparison to reference drug BHT and α-tocopherol (IC_{50}: 51.72 µg/mL & 15.83 µg/mL for DPPH and IC_{50}: 15.87 µg/mL & 8.45 µg/mL for ABTS, respectively). The iron-chelating activity of the extract was determined as comparable with the positive control EDTA (IC_{50}: 1022 µg/mL & 996 µg/mL, respectively) (Table 3).

Table 3. Total phenol and flavonoid content, and antioxidant activities of *C. ptosimopappa* methanol extract

Samples	Total phenolic (µg GAEs/mg)[b]	Total flavonoids (µg QEs/mg)[c]	Antioxidant activity (IC_{50} µg/mL)		
			DPPH scavenging activity	ABTS scavenging activity	Iron chelating Activity
C. ptosimopappa	17.61 ± 0.44	2.18 ± 0.01	3480 ± 0.88	462.2 ± 0.91	1022 ± 0.53
BHT	-	-	51.72 ± 1.54	15.87 ± 0.87	-
α-TOC	-	-	15.83 ± 0.44	8.45 ± 0.22	-
EDTA	-	-	-	-	996.8 ± 1.74

a: Values expressed are means ± S.D. of three parallel measurements and values were calculated according to negative control. Values with different letters in the same column were significantly different ($p < 0.05$)

b: GAEs: Gallic acid equivalents ($y=0.0413x + 0.0440$ gallic acid ($r^2 = 0.9958$))

c: QEs : quercetin equivalents ($y=0.0362x + 0.0172$ quercetin ($r^2 = 0.9975$)).

Enzyme inhibition activity

As shown in Table 4, the extract demonstrated weak AChE inhibitory activity (16.96 ± 0.56%) and moderate BChE inhibitory activity (43.48 ± 2.88%) compared to galanthamine (85.22 ± 1.78% and 80.27 ± 1.09%, respectively).

Table 4. Enzyme inhibitory activities of *C. ptosimopappa* methanol extract and reference compounds[a]

Samples	AChE	BChE	Tyrosinase	Elastase	Collagenase
C. ptosimopappa	16.96 ± 0.56	43.48 ± 2.88	6.62 ± 1.51	21.86 ± 0.16	6.36 ± 0.04
Galanthamine[b]	85.22 ± 1.78	80.27 ± 1.09	-	-	-
Kojic acid[b]	-	-	88.43 ± 1.48	-	-
Oleanolic acid[b]	-	-	-	59.98 ± 1.06	-
Epicatechin gallate[b]	-	-	-	-	86.01 ± 1.32

a: Values are expressed as the mean ± standard deviation of three parallel measurements and values were calculated according to negative control (50 µg/mL).; b: Standard compound;

Regarding the activity against tyrosinase, the IC_{50} value was calculated for the methanol extract of *C. ptosimopappa* and the reference drug kojic acid. The methanol extract exhibited weak inhibitory activity (IC_{50} value: 5781 ± 0.63 µg/mL) against tyrosinase, while the IC_{50} value calculated for kojic acid was 88.43 ± 1.48 µg/mL. The result for this species is in agreement with the results of a previous study, ethyl acetate and chloroform extracts from 8 *Centaurea* species had low tyrosinase inhibitory activities ranging from 0.91 to 15.53% at the concentration of 2 mg/mL [47].

Based on the results, the methanol extract of *C. ptosimopappa* is rich in various phytochemicals, including terpenoids, steroids, phenolic acids, flavonoids, and their glycosides. The extract exhibits moderate antioxidant activity and iron chelating ability. It also shows weak to moderate enzyme inhibition activities against AChE, BChE, and tyrosinase compared to the reference drugs. These findings suggest that the methanol extract of *C. ptosimopappa* has potential medicinal properties, particularly in antioxidative and enzyme inhibitory applications.

DISCUSSION

Recently, several researchers have reported the phytochemical composition of some *Centaurea* species. Eser et al. reported previously nonacosane and octacosane were the main constituents determined in the hexane extract of *C. polypodiifolia* [48]. Phytol, 1,2-benzenedicarboxylic acid, hexadecanal, stigmast-5-en-3-ol, lupeol, and lupeol acetate were determined as major compounds in hexane extract of *C. depressa* via GC-MS[49].

Previous investigations of phytochemicals by LC-MS have shown the presence of major phenolic compounds, protocatechuic acid, chlorogenic acid, caffeic acid, coumarin, salicylic acid, vanillic acid and apigenin in *C. papposa* [31], protocatechuic acid, hexoside and ferulic acid in *C. baseri* [27], chlorogenic acid, ferulic acid and *p*-coumaric acid, isoquercitrin and coumarin from *C. cyanus* [50]. In a study, 11 phenolic compounds were isolated from endemic *C. ensiformis* P.H. Davis, namely are tacioside, protocatechuic acid, picein, scopoline, vicenin-2, schaftoside, neoschaftoside, and syringin [51]. When the phytochemical analysis results with LC-MS are evaluated, the results of our study and the phytochemical analysis results of different *Centaurea* species reported previously overlap, which shows that the analysis results of our study are reliable.

Free radicals are produced regularly and inflict severe damage to biomolecules and tissue, resulting in a variety of illnesses, the most common of which are widespread lysis and degenerative disorders in biological systems [52]. Phenolic compounds exhibit antioxidant capabilities because of their potential to scavenge free radicals and active oxygen species, including singlet oxygen and hydroxyl radicals [19].

In a former study, the TPC was found in ethyl acetate and butanol extracts of *C. africana* as 125.24 ± 10.14 and 53.03 ± 2.50 mg GAE/g extract, respectively [53]. The TFC was determined as 40.57, 28.57 and 24.92 mg QE/g from *C. orientalis*, *C. nigra*, and *C. phrygia* [54]. 5.83 and 7.69 mg QE/g from *C. aksoyi* and *C. amaena* [55]; 46.76 mg rutin equivalent (RE) per gram in *C. antalyense*, 45.94 mg RE/g in *C. polpodiifolia* and 29.43 mg RE/g in *C. pyrrhoblephara* [56]. These values were higher than the current study, this may be due to the difference of sample preparation methods, interference and environmental factors involved in the determination of raw materials. In addition, the difference of the standard substance that used to create the linear calibration in the experiment may cause the amount of the resulting TPC and TFC to be different.

In a study, DPPH scavenging activity of methanol extracts of *C. calcitrapa*, *C. spicata* and *C. ptosimopappa* were found with the IC_{50} value of 359, 1018 and 237 µg/mL, respectively [19]. Compared with the results, DPPH radical scavenging activity in this

study was found to be low, which may be related to the geographical location of the plant or the amount of phenolics affected by other environmental factors.

The methanolic extract of *C. ptosimopappa* demonstrated an IC_{50} value of 1022 ± 0.53 µg/mL for iron chelating activity. This value indicates moderate iron chelating potential compared to other *Centaurea* species. For instance, a study on *Centaurea calcitrapa* subsp. *calcitrapa* reported higher iron chelating activity with an IC_{50} value of 25.91 µg/mL [19]. Similarly, *Centaurea pulchella* showed strong antioxidant capacity, which often correlates with metal chelating activity [56]. These comparisons suggest that while *C. ptosimopappa* has iron chelating properties, its efficacy is relatively lower than some other species within the genus.

Previously, a study reported anticholinesterase potentials of three endemic *Centeaurea* species: the methanol extract of *C. polypodiifolia* var. *pseudobehen* (24.54%), followed by *C. antalyense* (21.25%) and *C. pyrrhoblephara* (14.31%) against AChE at 2 mg/mL concentration [57]. In our study, it was found to be higher at the same concentration against both AChE and BChE enzymes. In previous studies, it has been reported that there is a close relationship between phenolic compounds in the extracts and anticholinesterase activity [58]. In this context, it is thought that the total phenolic compounds of *C. ptosimopappa* detected in the LC-MS/MS analysis are responsible for its anticholinesterase activity.

Tyrosinase is involved in melanin biosynthesis and is responsible for the color of humans' different organs. The misregulated expression of tyrosinase leads to skin pigmentation disorders and unwanted browning of foods. Therefore, tyrosinase inhibitors are candidates for skin whitening agents as well as keeping the good appearance of foods [59].

Physiological aging and prolonged UV exposure reduce collagen, the main component of the skin matrix. Additionally, the loss of skin elasticity that occurs during wrinkle and tarmi formation is thought to result from the breakdown of elastin produced and released by dermal fibroblasts. Elastase is an enzyme that causes the degradation of the three-dimensional structure of elastin (Patent, JP2003342123A). For this reason, collagenase and elastase activity inhibitors, which have the effect of preventing aging and keeping the skin young by restoring and protecting the skin's elasticity from natural sources, are being researched. In the present study, the methanol extract of *C. ptosimopappa* showed weak elastase (21.86 ± 0.16 %) and collagenase (6.36 ± 0.04%) inhibitory activity, respectively, compared to the reference drug oleanolic acid (59.98 ± 1.06 %) and Epicatechin gallate (86.01 ± 1.32 %) at the concentration of 50 µg/mL (Table 4). In a study, the methanol extract of *C. pumilio* and its silver nanoparticles showed anti-elastase activity with the IC_{50} value of 54±3.6 and 45.5±2.9 µg/mL, respectively [60].

Conclusion

In conclusion, the LC-MS/MS analysis of methanol extract of aerial parts of *C. ptosimopappa* led to the phenolic acids (quinic acid, protocatechuic acid, and chlorogenic acid) and flavonoids (isoquercitrin, hesperidin, genistin, cosmosiin, acacetin, and luteolin). This is the first study to evaluate the *C. ptosimopappa* species in terms of both phytochemical analysis and antioxidant and enzyme inhibitory activity, which are the target mechanisms in the treatment of different diseases and disorders. Moderate antioxidant activity and weak enzyme inhibitory activity were detected on the methanol extract of the plant. For this reason, studies should be conducted to elucidate the advanced mechanism of action so that this species can be used in pharmaceutical formulations designed against reactive radicals rather than just being used as a medicinal plant.

Author contributions: NE and GY conceived and designed the experiment. NE, MAY performed the experiments. MB, GE, NE wrote the first draft of the manuscript. MA and AE carried out the statistical analysis. All authors have read and approved the final manuscript.

Conflicts of interest disclosure: The authors declare

no conflicts of interest.

Abbreviations

ABTS= 2,2'-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid)

AChE= Acetylcholinesterase

AEF= Ankara University Herbarium of Faculty of Pharmacy

DPPH= 1,1 Diphenyl 2 Picrylhydrazyl

BChE= butyrylcholinesterase

TFC= Total flavonoid content

TPC= Total phenolic content

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التحليل الكيميائي النباتي لنبات *Centaurea ptosimopappa* Hayek وتأثيراته المضادة للأكسدة والمثبطة للإنزيمات

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الملخص

تم تحديد التركيب الكيميائي النباتي، وقدرة مستخلص الميثانول المحضر من الأجزاء الهوائية لنبات *Centaurea ptosimopappa* على اصطياد الجذور الحرة، وخلب الحديد، وتثبيط إنزيمي أستيل كولين إستيراز (AChE) وبوتيريل كولين إستيراز (BChE)، بالإضافة إلى تثبيط إنزيم التيروزيناز والإيلاستاز والكولاجيناز. أظهر تحليل المستخلص باستخدام كروماتوغرافيا الغاز المقترنة بمطياف الكتلة (GC–MS) وجود حمض الأورسوليك، وحمض الأوليانوليك، والسوجينال، والألفا–أميرين (α–amyrin)، واللوبيول، و3–أسيتيل لوبيول بوصفها المكونات الرئيسية. إضافةً إلى ذلك، تم تحديد الأحماض الفينولية الرئيسية، بما في ذلك حمض الكينيك (6.009 ملغم من المادة المحللة/غم)، وحمض البروتوكاتيكويك (0.070 ملغم من المادة المحللة/غم)، وحمض الكلوروجينيك (0.230 ملغم من المادة المحللة/غم)، إلى جانب مركبات الفلافونويد، باستخدام تحليل كروماتوغرافيا السائل المقترنة بمطياف الكتلة الترادفي.(LC–MS/MS) أظهر المستخلص نشاطًا متوسطًا مضادًا للأكسدة وفق اختبارات DPPH (IC_{50} = 3.48 ملغم/مل) وABTS (IC_{50} = 0.462 ملغم/مل)، إضافةً إلى قدرة متوسطة على خلب الحديد (IC_{50} = 1.02 ± 0.53 ملغم/مل)، كما أظهر نشاطًا مثبطًا متوسطًا لإنزيم BChE بنسبة 43.48 ± 2.88%. في المقابل، أظهر المستخلص نشاطًا ضعيفًا في تثبيط إنزيمات AChE والتيروزيناز والإيلاستاز والكولاجيناز. وتشير هذه النتائج إلى إمكانية الاستفادة من المستخلص في تركيبات مضادة للأكسدة أو مضادة لعلامات الشيخوخة ذات مصدر طبيعي.

الكلمات الدالة: *Centaurea*؛ المركبات الفينولية؛ مضاد لعلامات الشيخوخة؛ مرض ألزهايمر.

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تاريخ استلام البحث 2024/10/1 وتاريخ قبوله للنشر 2025/4/24.