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Bioactive Content and *in vitro* Antioxidant and Enzyme-Inhibitory Potential of Leaf and Fruits of Parsnip (*Pastinaca sativa* L. subsp. *Urens*)

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ABSTRACT

Parsnip *(Pastinaca sativa* L. subsp. *urens)* is one of the species of *Pastinaca* genus. This plant has been traditionally used worldwide for the treatment of various diseases and cultivated for its nutritional values. The aim of this study was to determine the antimicrobial and enzyme-inhibitory potentials of the fruits and leaves of parsnips as well as their bioactive properties such as their antioxidant activities, total phenolic and flavonoid contents in their hexane and ethanol extracts. The total phenolic and flavonoid contents were determined using Folin-Ciocalteu and aluminum chloride colorimetric methods, respectively. The antioxidant activities of extracts were determined by three methods of DPPH and ABTS radical scavenging activities and iron-chelating ability. In the leaves, the highest total phenolic content (60.94 mg GAE/g extract) was found in ethanol extracts while the highest total flavonoid content (21.47 mg RuE/g extract) was determined in hexane extracts. Ethanol extracts of leaves showed the highest radical scavenging activities in both assays of DPPH and ABTS with the IC_{50} values of 1039±1.35 and 150.7±0.81 µg/mL, respectively. Growth inhibition zone diameters (mm) of PSFE, PSLE, PSFH, PSLH (2 mg/mL) against reference microorganisms were -/-/15/15, -/-/15/14, 10/10/22/15, -/-/15/14 and MIC values -20>/20>/20>/20>, 20>/20>/20>/2.5, 0.625/10/-/-, 20>/20>/20>/20> mg/mL for *Staphylococcus aureus ATCC6538, Micrococcus luteus ATCC9341, Bacillus subtilis ATCC6633, Candida albicans ATCC14053,* respectively. Antimicrobial activity was not determined against other reference microorganisms.

Keywords: Antioxidant, Enzyme inhibition, *Pastinaca sativa,* DPPH•, Antimicrobial

Şeker Havucu (*Pastinaca sativa* L. subsp. *urens*) Yaprak ve Meyvelerinin Biyoaktif İçeriği ile *in vitro* Antioksidan ve Enzim-İnhibitör Potansiyeli

ÖZ

Şeker havucu (*Pastinaca sativa* L. subsp. *urens*), *Pastinaca* cinsinin türlerinden biridir. Bu bitki, dünya çapında geleneksel olarak çeşitli hastalıkların tedavisinde kullanılmakta ve besin değerleri nedeniyle yetiştirilmektedir. Bu çalışmanın amacı, şeker havucu meyve ve yapraklarının antimikrobiyal ve enzim inhibe edici potansiyelleri ile bunların antioksidan aktivitesi, toplam fenolik madde ve flavonoid içerikleri gibi biyoaktif özelliklerini belirlemektir. Toplam fenolik ve flavonoid içerikleri sırasıyla Folin-Ciocalteu ve alüminyum klorür kolorimetrik yöntemleri kullanılarak belirlenmiştir. Yaprak örnekleri arasında en yüksek toplam fenolik madde içeriği (60.94 mg GAE/g özüt) etanol özütünde bulunurken, en yüksek toplam flavonoid içeriği (21.47 mg RuE/g özüt) hekzan özütünde belirlenmiştir. Yaprak etanol özütü sırasıyla 1039±1.35 ve 150.7±0.81 µg/mL IC_{50} değeriyle en yüksek DPPH ve ABTS radikal

süpürücü aktivite göstermiştir. Meyve ve yaprakların etanol ve hekzan özütlerinin *Staphylococcus aureus ATCC6538, Micrococcus luteus ATCC9341, Bacillus subtilis ATCC6633, Candida albicans ATCC14053* mikroorganizmalara karşı büyüme inhibisyon zon çapı (mm) 2 mg/mL konsantrasyonda -/-/15/15, -/-/15/14, 10/10/22/15, -/-/15/14 ve MIC değerleri ise sırasıyla -20>/20>/20>/20>, 20>/20>/20>/2.5, 0.625/10/-/-, 20>/20>/20>/20> mg/mL olarak tespit edilmiştir. Diğer mikroorganizmalara karşı herhangi bir antimikrobiyal aktivite tespit edilmemiştir.

Anahtar Kelimeler: Antioksidan, Enzim inhibisyon, *Pastinaca sativa,* DPPH•, Antimikrobiyal

INTRODUCTION

Despite the great successes of herbal active substances (alkaloids, glycosides and others) and synthetic chemical compounds in the field of medicine, the medicinal plants still have an important place in the treatment of some diseases. According to the report of the World Health Organization, 80% of the world's population uses herbal treatment as a primary treatment method. Compared to before the 90s, it is seen that new herbal medicines have entered the treatment rapidly in the last 20-25 years and their use has become very common all over the world and in Türkiye. Developments in the pharmaceutical industry accelerated the production of synthetic drugs and the information about herbal medicines started to decrease. However, in the following years, because of the side effects in the use of synthetic preparations, the interest in the use of herbal medicines has gained momentum with the adoption of the philosophy of returning to nature. Parallel to this, pharmacological and clinical studies on herbal medicines have increased rapidly [1].

Vegetables and herbs used as spices are important in terms of protecting our health due to the secondary metabolites they contain. Especially vegetables and spices in the Apiaceae family have various health benefits due to the rich essential oil and coumarin compounds they contain [2]. *Pastinaca* is a genus of 15 species endemic to Eurasia that belongs to the Apiaceae family and the Tordylieae tribe. 'Pastus' (Latin) denotes food, nourishment, or something grown for eating [3]. Parsnip (*Pastinaca sativa*) is an edible root that has long been used in the cooking and preparation of infant food and livestock feed [4]. Parsnip root is a popular vegetable that may be eaten fresh, boiled, baked, fried, or roasted. According to previous studies, the important phytochemical components detected in parsnips are: coumarins, furanocoumarins, polyacetylenes, essential oils, terpenes and flavonoids [5-7]. Topical and oral use of parsnip is recommended for treatment of headaches, stomatitis, ophthalmitis, dermatitis and fever in traditional medicine [8]. Different parts of parsnip were used in folk medicine, for example, the root and leaf infusions were used for improve appetite, milk production as well as digestive and diuretic properties in Serbia [9], while in Italy the infusion of root and leaves was used for dietetic, cholagogue and diuretic purposes [10]. In the previous pharmacological activity studies on *P. sativa* species, there are studies such as antimicrobial and cytotoxicity [11]. Certain skin illnesses, such as vitiligo, mycosis fungoides and psoriasis are treated with a combination of psoralen or xanthotoxin with UV radiation (PUVA). Furanocoumarins are effective in the treatment of diseases such as psoriasis and mycosis fungoides due to their anti-proliferative effect, which causes selective photo-induced lesions to DNA [12]. In this context, *P. sativa* plant gains importance because it is rich in furanocoumarins. However, the studies on biological activities of different parsnip species were very limited.

The aim of this study was to analyze and statistically compare the antioxidant, antimicrobial and enzyme inhibitory activity of ethanol and hexane extracts prepared from leaves and fruits of *P. sativa* subsp. *urens*, which is a wild- growing relative of *P. sativa.*

MATERIALS and METHODS

Plant Materials

Pastinaca sativa L. subsp. *urens* (Req. Ex Gren. & Godr.) Čelak*,* as a whole plant was harvested from Beyşehir, located in the Konya province of Turkey (C4: Konya, Beyşehir, Beyşehir-Konya road's 1st km. stream side, 1200 m, 17.07.2018). The plant material was determined by a botanist specialist (Süleyman Dogu, Assoc. Professor at Department of Biology), works in Necmettin Erbakan University. Voucher specimen was kept in Herbarium of Necmettin Erbakan University (herbarium code: S DOĞU 3087). After the plant material was dried in the shade, it was pulverized into fine powder by laboratory type miller and sieved through a mesh size 80 to obtain a fine powder of uniform size.

Preparation of Plant Extracts

Twenty grams of each plant powder (fruits and leaves) was extracted with 300 mL of hexane and ethanol for 3 h in Soxhlet apparatus separately. The extracts were concentrated under vacuo using a rotary evaporator (Buchi, Switzerland) at 40°C to yield hexane and ethanol extract (Table 1). The extracts were kept in the refrigerator until utilization for *in vitro* assays.

Bioactive Contents of Plant Extracts

The total phenolic (TPC) and flavonoid contents (TFC) of the ethanol and n-hexane extracts of parsnips were determined using spectrophotometric methods, such as Folin-Ciocalteu [13] and aluminum chloride [14] methods, respectively. The total phenolic content was expressed as milligram of gallic acid equivalents per gram of extract (mg GAE/g extract). The quantities of total flavonoids were expressed as mg equivalence of rutin over gram of extract (mg RuE/g extract).

The antioxidant capacity of plant-derived compounds or extracts must be assessed using techniques that

consider the mechanism of antioxidant action. Therefore, in this study, the iron chelating activity (ICA), 2,2-diphenyl-1-picrylhydrazyl (DPPH•) and 2,2-azinobis (3-ethylbenzothiazoline-6-sulfonate) radical ($ABTS^{+}$•) free radical scavenging assays were used to assess the antioxidant capacity of the extracts. The DPPH radical scavenging activity was measured according to the method of Clarke [13]. The ABTS model was used as an alternative radical scavenging capacity test and was estimated using method of Re [15] with some modifications. The iron chelating activities of the extracts were determined by their interaction with the formation of the ferrozine-Fe^{2+} complex [16].

Enzyme Inhibition Potentials

Anticholinesterase effects were assessed by slight modifying the Ellman's method in advance [17]. The tyrosinase inhibition effect was also carried out using the reported earlier technique, with L-dopa serving as the substrate, and kojic acid serving as a standard agent [18]. Moreover, as initially disclosed, α-glucosidase inhibition effect was measured by microplate assay [19]. Additionally, the α-amylase inhibition experiment was subjected by adapting the procedure used by Caraway-Somogi iodine/potassium iodide method [20].

Antimicrobial Activity

The antimicrobial activity of the ethanol and n-hexane extracts of parsnips at different concentrations was determined by disc diffusion and broth microdilution method. *Escherichia coli ATCC8739, Salmonella typhimurium ATCC14028, Pseudomonas aeruginosa ATCC9027, Staphylococcus aureus ATCC6538, Staphylococcus epidermidis ATCC12228, Micrococcus luteus ATCC9341, Bacillus subtilis ATCC6633, Candida albicans ATCC14053* were used as the reference microorganisms in these tests.

In the disk diffusion assay, reference microorganisms at a density of 0.5 MacFarland were spread on Mueller Hinton Agar (Neogen, Lot No:UK305171/109) and Sabouraud Dextrose Agar (Neogen, Lot No:209791/190) surface respectively bacterial and yeast strain. 10 µL different concentrations of the ethanol and n-hexane extracts of parsnips (2-1-0.5 mg/mL) were dropped onto the surface of medium and incubated for at 37°C 18-20 hours for bacteria and 22°C 48 hours for yeast. Gentamicin (10 µg) and Fluconazole (25 µg) were used as positive controls for bacterial and yeast strains, respectively. Sterilizing distilled water was used as a negative control. Formed that growth inhibition zone diameters were measured after incubation [21]. This test was repeated three times.

Broth microdilution method was used to determine the minimal inhibitory concentrations (MICs), and different concentrations of the ethanol and n-hexane extracts of *P. sativa L.* subsp. *urens* (50-0.05 mg/mL), Mueller Hinton Broth (MHB) (Liofilchem, Lot No: 080718502) for bacteria and Sabouraud Dextrose Broth (SDB) (Neogen, Lot No: UK318137/333) for yeast were used. First wells and other wells of microplate were filled 50 µL of MHB or SDB. The ethanol and n-hexane extracts of *P. sativa L.* subsp. *urens* were dissolved in DMSO and added to the first well (50 µL). Then serial two-fold dilutions were made. Microorganism suspensions were prepared at a density of 0.5 MacFarland ($1.5x10^{8}$ cfu/mL). These were subsequently diluted to 10^{5} cfu/mL- 10^{3} cfu/mL respectively bacteria and yeast strains. Then microorganism suspensions were added to all wells (50 µL). Microplates were incubated at 37°C, 18-20 hours for bacteria and 22°C 48 hours for yeast and read at a OD_{620nm}. Each test included growth and sterility control. The lowest concentration without growth was determined as MIC [22]. This test was repeated 3 times. Vancomycin and Fluconazole were used as positive control bacteria and yeast strain, respectively. Those with only medium in the wells were considered as sterility control, and those with medium and bacteria/yeast strains were considered as growth control.

To determine minimal bactericidal (MBC) and fungicidal concentrations (MFC), microplate wells in which no growth was observed were inoculated on 100 µL Nutrient Broth (NB) and SDB for bacteria and yeast strains, respectively. Liquid cultures were incubated 18-24 hours for bacteria and 48 hours for yeast strain. The lowest concentration with no visible growth was defined as MBC/MFC [23].

Statistical Analysis

Each bioactivity test was conducted in triplicate during the experimental procedures. Three parallel assessments' mean were utilized to summarize the results. The significance was analyzed using one-way ANOVA followed by Tukey's test. If the p value was less than 0.05, the difference was statistically viewed as significant.

RESULTS and DISCUSSION

In this study, the bioactive compounds of the hexane and ethanol extract prepared from the fruit and leaves of parsnips were determined in terms of TPC and TFC, the results are shown in Table 1. Among the extracts, the highest TPC was observed in the PSLE extract (60.94 mg GAE/g extract) followed by the PSFE extract (41.75 mg GAE/g extract). However, the TFC was highest in PSLH extract (21.47 mg RuE/g extract) followed by the PSFH extract (12.34 mg RuE/g extract). According to the results, while ethanol solvent is the best solvent for obtaining phenolic compounds from this plant, hexane seems to be a better solvent for obtaining flavonoids. The Folin-Ciocalteu method, that used for the determination of total phenol content, may cause the results obtained to be higher than the actual value due to the reaction of reducing agents as well as phenolic compounds. Furthermore, the fact that the method is carried out in aqueous media limits the measurement of lipophilic phenolic compounds. To overcome these limitations, the use of chromatographic assays is recommended for future studies.

Many disorders, including autoimmune diseases, inflammation, Parkinson's and neurodegenerative

diseases, aging, cataracts, arteriosclerosis, and cancer, are influenced by oxidative stress [24]. There are reports about the high correlation of phenolic compounds with their antioxidant potential [25]. Therefore, plant phenolics have a great interest in developing natural antioxidants. In a study, the total phenolic content of root and fruit extracts of *Pastinaca sativa* L. subsp *urens* was found as (67.86±1.02 mg GAE/g extract) and (50.40±1.40 mg GAE/g extract), respectively [26]. In another study, the TPC was reported for methanol extract of *Pastinaca ferulacea* as 65.1 mg/g gallic acid [27].

Antioxidants prevent cell damage by reducing oxidative stress caused by free radicals. Therefore, determining the antioxidant capacity of herbal extracts may provide important health benefits. The high phenolic content of parsnips reveals the potential for potent antioxidant activity.

Table 1. Extract yield, total phenolic and flavonoid contents, and antioxidant activities of *Pastinaca sativa L.* subsp. *urens* hexane and ethanol extracts[a]

Extract/ Reference*	Extract yield (%, g/g)	Total phenolic (*m*g GAEs/g)[b]	Total flavonoids (*m*g RuEs/g)[c]	Antioxidant activity (IC_{50} µg/mL)		
				DPPH	ABTS	Iron chelating
PSFH	5.50	33.30±0.44	12.34±1.98	45303±0.61	1142±0.79	-
PSFE	10.73	41.75±4.07	3.98±0.49	2365±0.92	280.4±0.79**	8130±0.60
PSLH	1.82	32.32±1.77	21.47±8.37	-	585.5±0.84*	1090±0.77
PSLE	13.48	60.94±3.44	0.07±3.09	1039±1.35*	150.7±0.81**	4816±1.35
Quercetin		-	-	168.5±1.99*	-	
BHT		-	-	-	163.4±1.24**	
EDTA		-	-	-	-	822.6±2.46

a: The data was presented as the averages ± standard deviations of three parallel calculations. b: GAEs. Gallic acid equivalents (y = 0.0027x + 0.0084 gallic acid (mg) (r^2 = 0.997)). c: REs. Rutin equivalents (y = 0.0056x + 0.1313 rutin (mg) (r^2 = 0.993)). *PSFH: Hexane extract *of P. sativa* fruit; PSFE: Ethanol extract *of P. sativa* fruit; PSLH: Hexane extract *of P. sativa* leaves; PSLE: Ethanol extract *of P. sativa* leaves

Enzyme Inhibitory Activity

Enzyme inhibitors play an important role in the treatment of various diseases. In particular, α-glucosidase inhibitors are used in the treatment of diabetes. Therefore, the study of enzyme inhibitory activities of parsnip extracts is critical for the discovery of potential therapeutic agents. Acetylcholine is a neurotransmitter found at the intersections of nerves and muscles, lymph nodes of the motor systems of internal organs, and various parts of the central nervous system. The reduction of acetylcholine in the brain causes Alzheimer's disease. Therefore, it is an important agent for this disease. Studies have reported that increases in acetylcholine levels due to cholinesterase inhibition is a target therapeutical strategy for Alzheimer's disease [28]. Cholinesterase inhibitory activities of *P. sativa* L. subsp. *urens* ethanol and hexane extracts were screened according to the Ellman method and the results are given in Table 2. PSLE displayed the best inhibitory activity against AChE (IC_{50}: 798.4±1.15 µg/mL), while the PSFH extract showed the best inhibitory activity on the BChE (IC_{50}: 242.9±2.25 µg/mL).

The dopachrome method was used to test tyrosinase inhibitory activities of *P. sativa* L. subsp. *urens* ethanol and hexane extracts. As it is given in Table 2, PSFE extract showed inhibitory activity against tyrosinase with the IC_{50} value of 999.2±0.98 µg/mL while the reference compound kojic acid was exhibited tyrosinase inhibitory activity with the IC_{50} value of 190.7±0.79 µg/mL. The other extract exhibited lower tyrosinase inhibitory activity in the following order: PSLE>PSLH>PSFH.

Table 2. Enzyme inhibition effects of *Pastinaca sativa* L. subsp. *urens* extracts[a] (IC_{50} µg/mL)

Extract/ Reference[b]	AChE	BChE	Tyrosinase	α-glucosidase	α-amylase
PSFH	2115±2.58	242.9±2.25**	3781±0.47	2644±0.92	22338±0.42
PSFE	23702±0.62	660.6±1.44*	999.2±0.98	233.0±3.12*	13775±0.41
PSLH	8515±0.12	22556±0.32	1800±0.66	2184±0.73	845.9±1.44**
PSLE	798.4±1.15*	545.6±2.28*	1557±0.55	5.38±0.29***	1585±4.40
Galanthamine	132.4±2.24**	54.00±0.26**	-	-	-
Kojic acid	-	-	190.7±0.79*	-	-
Acarbose	-	-	-	1794±0.88	5705±0.27

[a]:IC_{50} values were presented as the averages plus standard deviations of three parallel calculations. [b]:PSFH: Hexane extract *of P. sativa* fruit; PSFE: Ethanol extract *of P. sativa* fruit; PSLH: Hexane extract *of P. sativa* leaves; PSLE: Ethanol extract *of P. sativa* leaves. *, **, *** means for marking significance levels of P<.05, P<.01, P<.001.

The α-glucosidase enzyme is one of the important target enzymes that is used in antidiabetic therapeutic. The enzyme converts the polysaccharide into monosaccharide in the intestine, which is the main reason for raising postprandial glucose level. Antidiabetic activities of *Pastinaca sativa* L. subsp.

urens extracts on a-amylase and a-glucosidase were determined by spectrophotometric method. As it presented in Table 2, the highest α-amylase inhibitory activity was found in PSLH extract (IC_{50}: 845.9±1.44 µg/mL) while the best α-glucosidase inhibitory activity was observed in PSLE extract (IC_{50}: 5.38±0.29 µg/mL). In a former study, the crude extract of *P. sativa* showed α-glucosidase and α-amylase inhibitory activity with the IC_{50} value of 88.05±1.25 µg/mL and 91.69±1.5 µg/mL, respectively [29].

Antimicrobial Activity

Antimicrobial agents help to control infections by inhibiting the growth of pathogenic microorganisms. In this study, determination of the antimicrobial activity of Parsnip is important for the discovery and development of natural antimicrobial agents (Figure 1). Growth inhibition zone diameters (mm) of PSFE, PSLE, PSFH, PSLH against reference microorganisms and MIC values were shown in Table 3. As can be seen from the results, growth inhibition zone diameters (mm) of PSFE, PSLE, PSFH, PSLH (2 mg/mL) against reference microorganisms were -/-/15/15, -/-/15/14, 10/10/22/15, -/-/15/14 and MIC values were found as 20>/20>/20>/20>, 20>/20>/20>/2.5, 0.625/5/20>/20>, 20>/20>/20>/20> mg/mL and MBC/MFC values were found as 20>/20>/20>/20>, 20>/20>/20>/2.5, 0.625/10/-/-, 20>/20>/20>/20> mg/mL for *Staphylococcus aureus ATCC6538, Micrococcus luteus ATCC9341, Bacillus subtilis ATCC6633, Candida albicans ATCC14053,* respectively.

Table 3. The growth inhibition zone diameter of PSFE, PSLE, PSFH and PSLH* determined by disc diffusion method

Reference Microorganisms	Growth Inhibition Zone (mm) 1-2-3-4 (PSFE, PSLE, PSFH, PSLH)				MIC (mg/mL) 1-2-3-4	MBC/MFC (mg/mL) 1-2-3-4
	2 mg/mL	1 mg/mL	0.5 mg/mL	Positive Control		
Escherichia coli ATCC8739	-/-/-/-	-/-/-/-/	-/-/-/-	7	-	-
Salmonella typhimurium ATCC14028	-/-/-/-	-/-/-/-	-/-/-/-	7	-	-
Pseudomonas aeruginosa ATCC9027	-/-/-/-	-/-/-/-	-/-/-/-	16	-	-
Staphylococcus aureus ATCC6538	-/-/-/-	-/-/-/-	-/-/-/-	22	-	-
Staphylococcus epidermidis ATCC12228	-/-/15/15	-/-/12/14	-/-/-/-	32	20>	20>
Micrococcus luteus ATCC9341	-/-/15/14	-/-/14/12	-/-/13/10	32	20>/20>/20>/2.5	20>/20>/20>/2.5
Bacillus subtilis ATCC6633	10/10/22/15	-/6/15/13	-/-/-/11	30	0.625/5/20>/20>	0.625/10/-/-
Candida albicans ATCC14053	-/-/15/14	-/-/12/12	-/-/-/-	15	20>	20>

*PSFH: Hexane extract *of P. sativa* fruit; PSFE: Ethanol extract *of P. sativa* fruit; PSLH: Hexane extract *of P. sativa* leaves; PSLE: Ethanol extract *of P. sativa* leaves

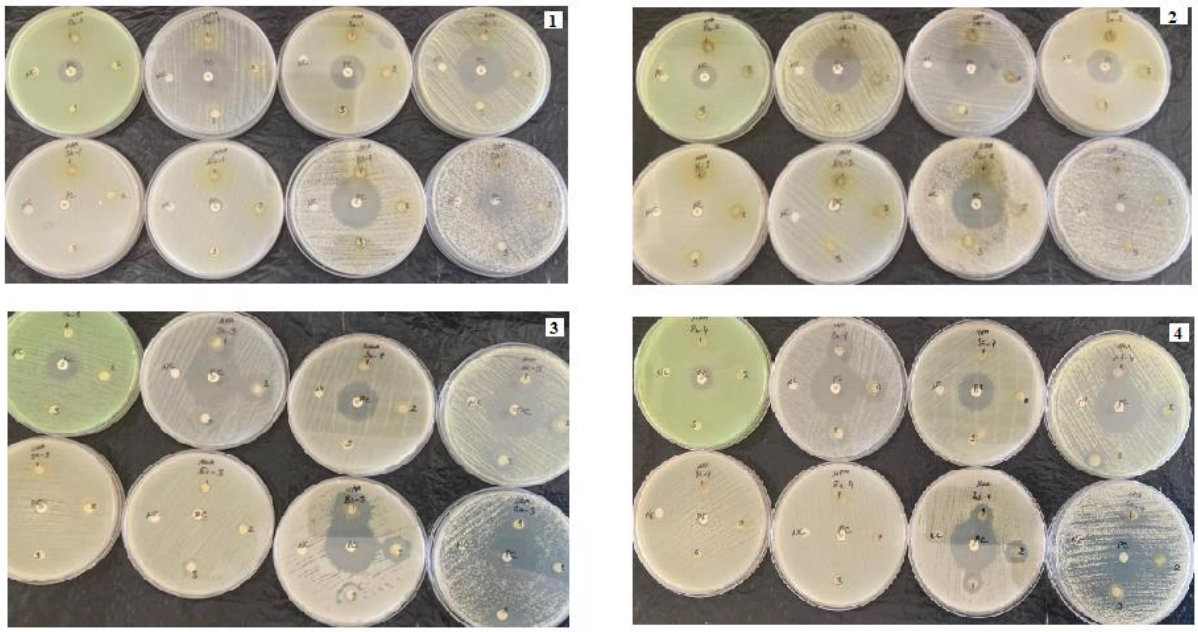

Figure 1. Antimicrobial activity of PSFE (1), PSLE (2), PSFH (3), PSLH (4) (2-1-0.5 mg/mL) by disc diffusion method (PSFH: Hexane extract *of P. sativa* fruit; PSFE: Ethanol extract *of P. sativa* fruit; PSLH: Hexane extract *of P. sativa* leaves; PSLE: Ethanol extract *of P. sativa* leaves)

Determination of the MIC is important for diagnostic laboratories due to it helps in confirming resistance of microorganism to an antimicrobial agent. It is a highest dilution or least concentration of the extract that inhibit

growth of microorganism. Therefore, the lower the MIC value of the plant extract, the higher its antimicrobial activity. According to some authors, plant extracts with MICs <100 µg/mL were considered highly active antimicrobial agents; MICs ranging from 100 to 500 µg/mL were classified as active; MICs ranging between 500 and 1000 µg/mL were considered moderately active; MICs ranging from 1000 to 2000 µg/mL were considered to have low activity; and MICs >2000 µg/mL were classified as inactive [30]. When evaluated accordingly, since the MIC value of the PSFE extract was 0.625 mg/mL, it showed moderate antimicrobial activity against *Bacillus subtilis*, while other extract inactive against the tested microorganisms.

In a previous study, the essential oil of three parsnip species were investigated for antimicrobial activity using microdilution method against *Candida tropicalis, C. parapsilosis, C. krusei, C. glabrata, C. albicans, Staphylococcus aureus, Bacillus cereus, Listeria monocytogenes, Escherichia coli, Salmonella typhimurium* and *Enterobacter cloacae;* with the minimum inhibition concentration (MIC) between 0.25–8 mg/mL and minimum bactericidal concentration (MBC) between 0.5–16 mg/mL [31].

CONCLUSION

Antioxidant, antimicrobial, and enzyme inhibitory activities of hexane and ethanol extracts of parsnip fruits and leaves were investigated with total phenolic and flavonoid contents in this current study. This study is the first investigation of the antimicrobial and enzyme inhibitory activities of parsnip. This shows that the study makes an important contribution to the literature. Moreover, In the study, the activities of compounds with different polarities were compared using both hexane and ethanol extracts. This allows the biological activities of the parsnip to be evaluated from a broader perspective. It was determined that PSLE extract with the highest total phenolic contents had the best antioxidant activity in all studied assays except iron chelating assay. When the extracts showed moderate enzyme inhibitory activities, PSLE extract showed superior inhibitory activity against α-glucosidase. Also, PSFE extract showed highest antimicrobial activity on *Bacillus subtilis* with the MIC value of 0.625 mg/ml, while the PSLH extract showed highest antimicrobial activity on *Micrococcus luteus* with the MIC value of 2.5 mg/ml. This study can be considered as the first investigation on antimicrobial and enzyme inhibitory activities of *P. sativa*. In the continuation of this study, it is thought that these plants, which are used for different purposes in folk medicine, will contribute more to the research of biological activity and the production of products that can be used as food support.

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