RESEARCH ARTICLE

Physiochemical Analysis, Antioxidant Activity, Antimicrobial Activity and Phenolic Profile of *Ipomoea eriocarpa* R. Br. Leaves

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Received: 25th March, 2024; Revised: 08th July, 2024; Accepted: 04th August, 2024; Available Online: 25th September, 2024

ABSTRACT

Many active substances found in plants are essential in the treatment of transmissible and non-transmissible ailments. To enhance their well-being and capabilities, most people around the globe use medicines from plants and herbal origin. The goal of the current study was an assessment of physiochemical properties as well as measuring the effect of various solvents (ethanol, chloroform, and water) on the phenolic profile and on free radical scavenging potential. The standard procedures were used for the preliminary phytochemical, physiochemical and fluorescence analysis. Folin-Ciocalteu and colorimetric methods were used to determine the quantitative phytochemical analysis, respectively. The free radical scavenging potential was determined through 2,2-diphenyl-1-picrylhydrazyl (DPPH) and 2,2′′-casino-bis (3-ethylbenzothiazoline-6-sulphonic) acid (ABTS) assays. The antimicrobial activity was assessed using the disk diffusion method on a range of bacterial and fungal strains. The finding showed that ethanol was the best solvent for extracting polyphenols. The presence of alkaloids, carbohydrates, flavonoids, glycosides, phenolic compounds, and tannins was observed in the plant.

Additionally, fluorescence characteristics and physiochemical parameters provided valuable data that can be used to establish standards for this plant. Results of quantitative phytochemical estimation revealed that the ethanol extract had a higher phenolic content (71.82 mg/g GAE) and flavonoid content (82.7 mg/g QE), while the aqueous extract had the lowest phenolic content (27.05 mg/g GAE) and flavonoid content (18.93 mg/g QE). The *I. eriocarpa* ethanolic extract had the maximum scavenging potential against DPPH (32.36 µg/mL) and ABTS (55.54 µg/mL). The results of the antimicrobial activity assessment also indicate that the ethanol extract exhibited a greater inhibition zone when tested against both bacterial strains. Results of thecurrent study suggested that the ethanolic extract has significant antioxidant potential and has the capability of being a notable source of organic antioxidants for the formulation of functional foods.

Keywords: *Ipomea eriocarpa,* Antioxidant, Phytochemical analysis, Antimicrobial.

International Journal of Drug Delivery Technology (2024); DOI: 10.25258/ijddt.14.3.39

How to cite this article: Singh PK, Rawat AKS. Physiochemical Analysis, Antioxidant Activity, Antimicrobial Activity and Phenolic Profile of *Ipomoea eriocarpa* R. Br. Leaves. International Journal of Drug Delivery Technology. 2024;14(3):1531-1538.

Source of support: Nil.

Conflict of interest: None

INTRODUCTION

Natural remedies play a crucial role in the marketing and development of new drugs.[1] Phyto compounds extracted from medicinal plants make up nearly 25% of conventional medicines.[2] The World Health Organization (WHO) estimates that approximately 80% of people in developing countries primarily rely on plants for basic healthcare.[3] The antioxidant properties of medicinally useful botanicals have been the subject of research.[4]

Previous research has demonstrated that flavonoids, a variety of carotenoids, phenolics, vitamins (C & E), and flavonoids are all primarily responsible for their antioxidant properties.[5-7] As a result of electron transport processes during aerobic respiration, reactive oxygen species (ROS) are constantly produced in the human body and play important roles in homeostasis and cell signaling. The overproduction of ROS is frequently linked to oxidative stress, which causes oxidative damage to DNA, lipids, and proteins in cells.[8]

The prevention of oxidative damage and chronic illness depends on antioxidants because they fight free radicals. Butylated hydroxytoluene (BHT), a synthetic antioxidant, has been subject to regulation because it is thought to cause cancer and damage to the liver.[9] As a result, research has been done on natural antioxidant substitutes with fewer side effects.[10] The pathology of radicals, or ROS, is associated with a number of diseases, including cancer, cardiovascular and neurodegenerative ailments, high blood pressure, diabetes, and premature aging.[11] ROS are produced by radiation, chemicals, toxins, deep-fried and spicy foods, and physical stress, which causes the immune system to produce abnormal proteins and

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run out of antioxidants.[12] Examples of antioxidant enzymes that are already present in the body include catalase, superoxide dismutase, and glutathione peroxidase.[13] These enzymes can eliminate free radicals and keep cellular processes running smoothly. In situations of increased oxidative stress, antioxidant defenses might not be enough to keep up adequate cellular functions, so antioxidants may be required in the diet.[14]

In recent times, researchers have directed their attention towards the rising prevalence of human infections caused by bacteria.[15] Medicinal plants have emerged as a valuable reservoir of antimicrobial agents. Due to the development of resistance by microorganisms against numerous antibiotics[16] there has been a growing interest in the utilization of plant extracts and their isolated compounds.[17]

Ipomoea eriocarpa R. Br. is a semi-aquatic annual plant in the Convolvulaceae family that can be found in tropical South America, northern Australia, tropical Africa, and tropical Asia.[18] The analysis of the chemical compounds found in the *Ipomoea* genus indicates that these plants contain a variety of biologically active constituents. These compounds include ergoline alkaloids, indolizidine alkaloids, nortropane alkaloids, phenolic compounds, coumarins, norisoprenoids, diterpenes, isocoumarin, benzenoid flavonoids, anthocyanins, glycolipids, lignans, and triterpenes. The seeds are full of protein and carbohydrates, making them nutritious. In addition, the plant is utilizedin India for a number of unidentified medicinal uses. The oil extracted from the plant can be used to treat fevers, rheumatism, leprosy, epilepsy, ulcers, and other ailments. *I.eriocarpa* recently gained recognition for its neuroprotective, antipyretic, antinociceptive, antioxidant, toxic, antisecretory, anthelmintic, and insecticidal properties. [19-20]

The purpose of this study was to evaluate the antioxidant activity, physiochemical properties, preliminary phytochemical screening, total phenolic content (TPC), total flavonoid content (TFC), and water, ethanol, and chloroform extracts of *I. eriocarpa* leaves. It is worth noting that this study represents the first-ever investigation of these parameters for this particular plant species. The findings from this research are expected to significantly contribute to a deeper understanding of the plant's potential for commercial applications.

MATERIALS AND METHODS

Collection and Authentication of Plant Material

The *I. eriocarpa* leaves were gathered from the surrounding area of Udalguri, Assam. Dr. Pankaj Sharma of the Himalayan Pradesh State Biodiversity Board in Shimla, India, identified, confirmed, and certified the plant (HIMCOSTE/HPSBB/279).

Physiochemical Analysis

Various physiochemical parameters like moisture content, ash value, foreign matter, fluorescence analysis, and extractive value were determined as per the standard procedure.[21]

Preliminary Phytochemical Screening

Phytochemical testing was performed on a number of *I. eriocara* leaf extracts.[22] Alkaloids, flavonoids, glycosides, tannins, proteins, saponins, fats, and steroids were identified through a series of identification tests viz. Mayer's test, Dragendroff's test, Hager's test, Wagner's test, Borntrager's test, Keller-Killiani test, Legal's test, Baljet's test, foam test, Molish's test, Fehling's test, Benedict's test, $FeCl_3$ solution test, gelatin solution test, lead acetate solution test, sulphuric acid test, Salkowski reaction, Leibermann-Burchard reaction, Millon's test, biuret test, xanthoprotein test, ninhydrin test, spot test.

Preparation of Extracts

The first step in drying the collected leaves was to wash the min water to get rid of any dirt or foreign objects. Then, after being ground into a coarse powder, the dried leaves were run through sieve No. 14. A humble-shaped soxhlet apparatus tube was used to extract the *I. eriocarpa* leaves that had been dried and powdered (20 g) using a variety of solvents, including ethanol, chloroform, and water (300 mL), at 60 to 65°C for 3 to 4 hours. All three extracts were hotly filtered before being evaporated and kept at low temperatures in their fridge at or for further investigation.

TPC and TFC analysis

TPC and TFC of *I. eriocarpa* leaf extracts were determined by the previously described method.[22] The TPC was expressed as mg of gallic acid equivalent (GAE), while TFC was expressed as mg of quercetin equivalents (QE) per 100 g of extract.

In-vitro Antioxidant Activity

DPPH radical-scavenging assay

The DPPH radical scavenging potential of each extract was determined by the previously described method.[23] The mixture of various plant extract concentrations and standard ascorbic acid was added to the DPPH radical solution (50M) separately. The EE, CE, and AE had concentrations ranging from 20 to 100 g/mL. The action mixtures were left in the dark for 30 minutes after being vigorously shaken. About 2 mL of DPPH solution and 2 Ml of methanol were combined to make the control solution. The absorbance of the control solution and each reaction mixture was measured at 517 nm.

The percentage inhibition was calculated by the following formula:

$$\% \text{ Inhibition} = \frac{AC517\ nm - AS517\ nm}{AC517\ nm} x\ 100 \quad (1)$$

where: AS: Absorbance of the Sample; AC: Absorbance of Control. The IC50 value was calculated by plotting the graph between the percent inhibition and various concentrations of plant extracts and ascorbic acid.

ABTS radical-scavenging assay

As mentioned earlier,[24] the reducing capacity of the *I. eriocarpa* extracts was assessed using the ABTS assay. Solutions of EE, CE, and AE were created at concentrations between 20 and 100 g/mL. 0.2 mL of samples at various concentrations were combined with 1-mL of distilled dimethyl

sulfoxide, and 0.16 mL of ABTS solution was added to make a volume of 1.36 mL. After 20 minutes, the absorbance was measured spectrophotometrically at 734 nm using a UV spectrophotometer.

$$\text{ABTS scavenging activity (\%)} = \frac{(A0-A1)}{A0} x100 \quad (2)$$

where, A 0: absorbance of the control, A1: absorbance of the sample.

In-vitro Antimicrobial Activity

Bacterial strains

The antibacterial screening of *I. eriocarpa* leaves extracts involved four pathogenic bacterial strains. Two-gram positive strains *Streptococcus mutans* (ATCC-700610) *Staphylococcus aureus* (ATCC 25923), and two-gram negative strains *Escherichia coli* (ATCC 25922), *Pseudomonas aeruginosa* (ATCC 27853) were purchased from Hi-Media laboratories.

Preparation of culture medium and inoculation

For the antibacterial activity assessment, a culture medium was prepared by suspending 35 g of nutrient agar and 10 g of agar-agar in 1000 mL of distilled water. The mixture was dissolved by boiling and then autoclaved at 15 lbs pressure for 20 minutes to sterilize both the media and petri dishes. After cooling under aseptic conditions, 20 mL of the sterilized media was dispensed into each petri dish, creating a uniform depth of 6 mm after solidification.

For the bacterial cultures, the concentration of the microbial suspension was adjusted to the 2.0 McFarland standard, ensuring standardized bacterial density. Next, 50 µL of each microorganism's suspension was spread on the surface of separate agar plates using a spread plating technique. This setup allowed the evaluation of the antibacterial activity of the *M. esculenta* leaves extracts against the different bacterial strains.

Disc application and incubation

To evaluate the antibacterial activity of *I. eriocarpa* extracts, 6 mm diameter discs were prepared using Whatman No. 1 filter paper. These discs were sterilized through autoclaving and then dried at 80°C for one hour. The sterilized discs were soaked in the respective *I. eriocarpa* extracts and left to dry for 3 to 5 minutes. Once dried, the discs were carefully placed onto the surface of nutrient agar using flamed forceps, ensuring proper contact with the agar. To prevent interference from the edges of the petri dishes and overlapping inhibition zones, the discs were spaced apart adequately. The petri dishes were then incubated in an inverted position at 37°C for 24 hours. After the incubation period, the diameter (mm) of the clear zone of growth inhibition around each disc was measured. The presence of a clear zone indicated antibacterial activity. Each bacterial strain and different solvent extracts, as well as the standard drug, were tested in triplicate for the antibacterial assay.[25]

RESULTS AND DISCUSSION

Physicochemical Evaluation

The physiochemical analysis results showed that the total ash value (2.81%) was found to be higher than the value of the sulfated ash (2.37%). The water-soluble ash value was 0.36%, while the acid-insoluble ash value was 0.51%. Further research revealed that the medication has a moisture content of 8.71%, no foaming or swelling index, and less than 1% foreign organic content. Ethanol, chloroform, and aqueous extract shad extractive values of 58.12, 3.63, and 14.17%, respectively. Table 1 provides a summary of the physicochemical parameter results.

Preliminary Phytochemical Screening

The extracts showed the presence of alkaloids, carbohydrates, flavonoids, phenolic compounds, tannins, and glycosides was confirmed by a number of phytochemical analysis tests, as shown in Table 2. When compared to the extracts made with

Table1: Physicochemical parameters of *I. eriocarpa* Leaves

Physiochemical parameters		*Results (%)*
Ash value	Total ash	2.81
	Acid in soluble ash	0.51
	Water soluble ash	0.36
	Sulphated ash	2.37
Extractive value	EE	58.12
	CE	23.63
	AE	14.17
Moisture content		8.71
Foreign organic matter		Less that 1% (Presence of Petioles talks with leaves)
Swelling index		Nil
Foaming index		Nil

Table 2: Preliminary phytochemical screening *I. eriocarpa* leaves extracts

Phyto-constituents	*Leaves extracts*		
	Ethanolic extract (EE)	*Chloroform extract (CE)*	*Aqueous extract (AE)*
Alkaloids	Absent	Present	Present
Carbohydrates	Present	Present	Present
Proteins & amino acids	Absent	Absent	Absent
Fixedoils&fats	Absent	Absent	Absent
Flavonoids	Present	Present	Present
Phenolic compounds	Present	Present	Present
Tannins	Present	Present	Present
Glycosides	Present	Present	Present
Saponins	Absent	Absent	Absent
Steroids	Absent	Absent	Absent

Table 3: Fluorescence analysis of *I. eriocarpa* leaves extract

S. No.	*Treatment*	*Visible light*	*UV light*	
			254 nm (Short wavelength)	*366 nm (Long wavelength)*
1	Leaves powder	Green	Light green	Light green
2	Leaves powder rubbed On filter paper	Light green	Light yellow	Light green
3	Leaves powder + 1N Hydrochloric acid	Brown	Black	Reddish brown
4	Leaves powder + 1N Sodium hydroxide	Light green	Light yellow	Light green
5	Leaves powder + 1N Nitric acid	Light yellowish green	Light yellow	Light yellow
6	Leaves powder + 1N Sulphuric acid	Light green	Light green	Light green
7	EE of leaves powder	Dark green	Black	Green
8	CE of leaves powder	Green	Green	Light green
9	AE of leaves powder	Greenish brown	No fluorescence	No fluorescence

ethanol and chloroform, the aqueous extract was found to be negative for the presence of alkaloids.

Fluorescence Analysis

The fluorescence properties of powdered drugs significantly influence the purity and quality of the drug components. When exposed to ultraviolet and visible light in the presence of different chemical reagents, the powdered drugs exhibit distinctive fluorescence.[20] The fluorescence care port for the powdered leaf of *I. eriocarpa* is presented in Table 3.

Total Phenolic Content (TPC)

The TPC method was chosen to assess the phenol content of plant extracts. These phenolic compounds can potentially act as antioxidants thanks to their redox properties.[26-27] To begin, the phenolic content of each extract was determined using the Folin-Ciocalteu reagent. In terms of gallic acid equivalents (GAE) per gram of dry extract weight, the results are shown in Table 4. According to the findings, the EE had a higher TPC than the CE and AE, with approximately 71.82 ± 0.34, 48.09 ± 0.28, and 27.05 ± 0.29 mg GAE/g, respectively. Based on the gallic acid calibration curve (y = 0.0051x + 0.447, R2 = 0.9807), the linear equation that follows was used to calculate TPC.

Each value represents the mean and standard error mean of three replicates. EE stands for ethanol extract, CE for chloroform extract, and AE for aqueous extract. Different letters denote statistical significance, which was established at $p < 0.05$.

The higher level of phenolic in the EE may indicate greater bioactivity, namely. Antimicrobial and antioxidant properties. Numerous studies have looked into the relationship between phenolic content and antioxidant activity. Earlier literature[27] reported that certain plant products' antioxidant activity was strongly correlated with the TPC. Previous studies stated that phenolic compounds play a role in the defense mechanisms of plants to prevent the formation of ROS, enhancing survival and guarding against molecular harm as well as attacks from microbes, insects, and herbivores.[28]

Table 4: TPC and TFC

Extracts	*TPC (mg/g GAE)*	*TFC (mg/g QE)*
EE	71.82 ± 0.34[a]	82.7 ± 0.27[a]
CE	48.09 ± 0.28[b]	32.74 ± 0.22[b]
AE	27.05 ± 0.29[c]	18.93 ± 0.27[c]

Total Flavonoid Content (TFC)

Flavonoids are antioxidant-active secondary metabolites whose potency is determined by the number and position of free OH groups.[29] Aluminum chloride was used in a colorimetric system to quantify the flavonoid content of a few plant extracts as a starting point. Table 4 shows the results in terms of quercetin equivalents (QE) per gram of dry extract weight. According to the findings, the EE had a higher TFC than the CE and AE, with approximately 82.37 ± 0.27, 32.74 ± 0.22, and 18.93 ± 0.27 mg QE/g, respectively. Based on the calibration curve of quercetin (y = 0.0063x + 0.396, R2=0.9796), the line is an equation that follows was used to calculate TFC.

Ethan oils are frequently used to extract natural plant compounds, such as the abundance of bioactive phytoconstituents in *I. eriocarpa* leaves. EE could explain the widespread therapeutic use of this folkloric botanical.

Among the many phenolic compounds found in plants, flavonoids make up a significant group. Fruits and vegetables benefit greatly from their color and flavor.[30] Flavonoids have the ability to scavenge radicals due to the presence of hydroxyl groups. The same idea that was used for TPC was used for TFC determination, where the presence of a flavonoid aluminum complex caused a color change.[31] According to Table 4, leaves of *I. eripcarpa* TPC and TFC values for EE were the highest, indicating that of the extracts under study, EE contains the most phenolic compounds. In contrast to other natural sources, *I. eriocarpa* is, therefore a promising source of phenolic compounds.

Antioxidant Activity

DPPH radical scavenging activity

One-electron reduction, which simulates the free radical-reducing activity of antioxidants, is the foundation of DPPH radical scavenging activity. As a positive control, ascorbic acid (AA) was used. The results (Figure 1) displayed the DPPH radical inhibition percentage of standard and crude extracts from *I. eriocarpa* at various concentrations. EE had the lowest IC_{50}, followed by CE and AE, with IC_{50} values of 32.36, 71.75, and 96.71 g/mL, respectively (Table 5). Ascorbic acid's IC_{50} was 16.30 g/mL. EE had a higher capacity to scavenge free radicals than CE and AE because it has a lower IC_{50} (concentration required for 50% inhibition) value. The high antioxidant activity observed by EE had a favorable correlation with TPC. Previous research has demonstrated a strong correlation between antioxidant capacity and both TFC and TPC.[29,30] *I. eriocarpa* EE demonstrated a dose-dependent capacity to scavenge DPPH radicals.

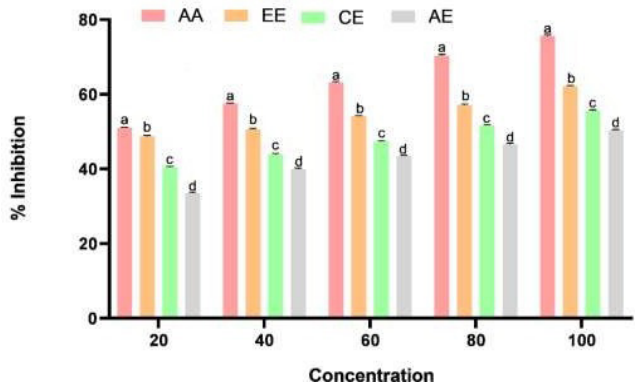
2,2'-azino-bis (3-ethylbenzothiazoline-6-sulphonic acid) assays

I. eriocarpa EE revealed a dose-dependent ABTS radical scavenging potential (Figure 2).

At 20 mg/mL, ascorbic acid inhibited the EE, CE, and AE in proportions of 39.41, 32.69, and 29.46%, respectively. Ascorbic acid had an IC_{50} value of

17.93 g/mL, while its EE, CE, and AE values were 55.54, 73.53, and 93.49 g/mL, respectively (Table 5).

Antioxidants play a significant role in preventing oxidative damage. They control diseases brought on by oxidative stress by neutralizing and dismantling free radical chains. However, in contrast to natural antioxidants, synthetic antioxidants like BHT, which are thought to cause liver damage and carcinogenesis [32,33] are controlled substances. Therefore, extensive research should be done on natural sources to find substitute antioxidants that are both safe and effective in order to reduce the negative effects.[34] Several naturally occurring substances derived from plants, such as lignin



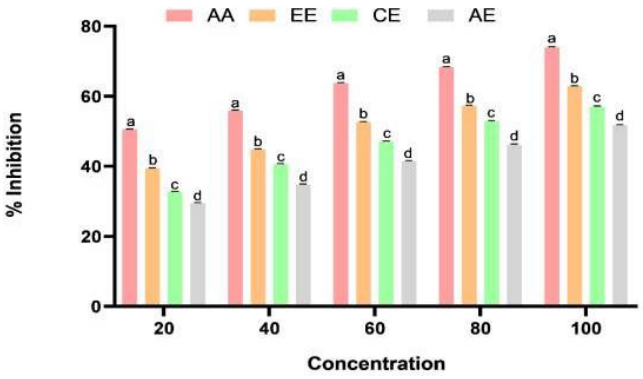
AA –Ascorbic acid; EE -Ethanolic Extract; CE -Chloroform Extract; AE -Aqueous Extract. Different letters denote statistical significance, which was established at p<0.05. (Each concentration was evaluated independently)

Figure 1: DPPH radical scavenging activity of *I. eriocarpa* leaf extracts

Table 5: IC_{50} values of *I. eriocarpa* extractsi in DPPH and ABTS radical scavenging

Crude extracts	*DPPH scavenging assay (µg/mL)*	*ABTS scavenging assay (µg/mL)*
AA	16.30 ± 0.14^{a}	17.63 ± 0.15^{a}
EE	32.36 ± 0.21^{b}	55.54 ± 0.18^{b}
CE	71.75 ± 0.17^{c}	73.53 ± 0.22^{c}
AE	96.71 ± 0.23^{d}	93.49 ± 0.19^{d}

Statistical significance was determined at $p < 0.05$ and is indicated with different letters.



AA – Ascorbic acid; EE -Ethanolic Extract; CE -Chloroform Extract. Statistical significance was determined at $p < 0.05$ and is indicated with different letters (each concentration was evaluated independently).

Figure 2: ABTS radicals scavenging activity of *I. eriocarpa* leaves extracts

secoisolariciresinol,[35] have proven to be effective substitutes for these synthetic antioxidants, which have the potential to be harmful. Because of their redox characteristics, phenolic compounds are efficient metal chelators, hydrogen givers, reducing agents, and singlet oxygen inhibitors.

The ABTS assay revealed a very high scavenging capacity for EE-specific ABTS + radicals. This study found that increasing the concentration of plant extract sin creased DPPH radical scavenging activity, which might suggest a greater ability to transfer a hydrogen atom and produce a lighter solution proportional to the number of electrons attained.[36] The ability of *I. eriocarpa* to transfer hydrogen atoms indicates that it scavenges DPPH by converting the radical to the corresponding hydrazine. However, it was discovered that the DPPH radical activity of the extracts was much greater than their ability toscavengeABTS+. The stereoselectivity of the radicals and their solubility in different solvent systems can have an impact on an extract's capacity to interact with and reduce different radicals. Additionally, it was discovered that some substances with ABTS+scavenging activity lacked DPPH scavenging potential.[37] In fact, access to an extract's capacity to scavenge free radicals is made possible by the antioxidant assays ABTS and DPPH. Their rigid mechanisms, though, are distinct from one another. ABTS is based on a strict hydrogen atom transfer (HAT) mechanism, whereas DPPH may also show the presence of antioxidants acting through an electron transfer (ET) mechanism in addition to

Table 6: Antibacterial activity of *I. eriocarpa* against gram positive bacteria

Extract concentration (µg/mL)	*Zone of inhibition (mm)*					
	S. mutans (ATCC-700610)			*S. aureus (ATCC 25923)*		
	EE	*CE*	*AE*	*EE*	*CE*	*AE*
10	13.22 ± 0.02	9.21 ± 0.04	4.95 ± 0.01	12.02 ± 0.03	7.09 ± 0.06	3.99 ± 0.01
20	13.57 ± 0.05	9.37 ± 0.02	5.06 ± 0.02	12.36 ± 0.01	7.13 ± 0.01	4.09 ± 0.06
50	13.92 ± 0.01	9.61 ± 0.01	5.33 ± 0.03	12.54 ± 0.00	7.43 ± 0.03	4.23 ± 0.02
100	14.00 ± 0.04	9.87 ± 0.02	5.74 ± 0.05	12.70 ± 0.01	7.83 ± 0.03	4.61 ± 0.10
Gentamicin	16.35 ± 0.02			15.96 ± 0.00		

Table 7: Antibacterial activity of *I. eriocarpa* against gram-negative bacteria

Extract concentration (µg/mL)	*Zone of inhibition (mm)*					
	E. coli (ATCC 25922)			*P. aeruginosa (ATCC 27853)*		
	EE	*CE*	*AE*	*EE*	*CE*	*AE*
10	12.14 ± 0.03	7.00 ± 0.03	3.16 ± 0.02	10.17 ± 0.02	6.07 ± 0.02	2.39 ± 0.02
20	12.40 ± 0.02	7.21 ± 0.04	3.44 ± 0.02	10.30 ± 0.01	6.27 ± 0.03	2.48 ± 0.01
50	12.60 ± 0.02	7.50 ± 0.02	3.46 ± 0.04	10.51 ± 0.03	6.3233 ± 0.03	2.5633 ± 0.03
100	12.8433 ± 0.02	7.77 ± 0.04	3.66 ± 0.03	10.64 ± 0.01	6.4833 ± 0.01	2.69 ± 0.01
Gentamicin	15.3833 ± 0.03			13.73 ± 0.02		

this HAT mechanism.[38] The current findings, therefore, point to the presence of antioxidants acting primarily through a HAT mechanism, while the slightly higher (but not significantly higher) antioxidant activity found using DPPH could point to the presence of antioxidants acting primarily through an ET mechanism.

Antimicrobial activity

Tables 6 and 7 presents the results of the antibacterial effects of *I. eriocarpa* leaf extracts. Gentamicin was used as the standard drug to evaluate the antibacterial potential. In this study, the ethanolic extract (EE) showed higher activity against *S. mutans*, *S. aureus*, *E. coli*, and *P. aeruginosa*, which are commonly associated with tooth decay, skin infections, soft tissue infections, bloodstream infections, urinary tract infections, food poisoning, bone and joint infections, abscesses, and contamination of normal heart valves in humans.[39]

E. coli is responsible for serious urinary tract infections and also serves as a source for the transfer of antibiotic-resistant genes from infected food animals to humans.[40] Given these findings, further investigation into the potential of *I. eriocarpa* extract against these pathogenic bacterial species are recommended, as it may hold promise in developing topical antimicrobial therapies against the diseases and infections caused by these pathogens.

However, in this, the most thorough phytochemical analysis of this significant folk medicine plant to date, we provide new information on the potential mechanism by using the stew of different radical scavenging assays in relation to other relative phytochemical compositions of each extract. The relationship between phenolic compounds and antioxidant activity is well-described. Additionally, it is widely accepted that a variety of variables, including the phytochemical composition, which is closely related to the chosen extraction method,[41,42] may have a significant impact on the antioxidant activity. We investigated the antioxidant activity and phytochemical profile of *I. eriocarpa* extract using different extraction solvents. When it comes to the antioxidant potential and phytochemical diversity of the sample, ethanol extraction produces the best results in this instance.

CONCLUSION

Due to their abundance in phytochemicals like phenolics and flavonoids, this study showed that *I. eriocarpa* leaf extracts has intriguing antioxidant and antimicrobial properties. The TPC and TFC quantification for each *I. eriocarpa* extract (EE, CE, and AE) demonstrated the significant influence of the chosen extraction solvent on both the content and composition of bioactive compounds. In terms of TPC and TFC, *I. eriocarpa* EE was the richest species. New details were also provided here regarding *I. eriocarpa*: potential antioxidant mechanisms, particularly its potential role as a free radical scavenger. The phenolic acid and flavonoid content of the various *I. eriocarpa* extracts appears to be closely related to their biological activity. Additional insights were offered regarding the potential antioxidant mechanisms of *I. eriocarpa*, highlighting its role as a scavenger of free radicals. Notably, the *I. eriocarpa* methanol extract displayed pronounced antimicrobial efficacy against various bacterial strains, including both gram-positive and gram-negative strains. The observed biological effects of different *I. eriocarpa* extracts appear to be intricately linked to their content of phenolic acids and flavonoids. Therefore, given the impressive antioxidant properties of *I. eriocarpa* leaf extracts, their consumption should be further promoted as this plant may play a significant role in preventing a

number of health disorders involving the overproduction of free radicals, such as carcinoma, cardiovascular diseases, and premature aging. To develop promissory foods and/or cosmetic preservatives, a more in depth study is required on the isolation and individual characterization of bioactive compounds.

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