RESEARCH PAPER

Antibacterial And Antioxidant Activity Of Prosopis Cineraria Leaf Extract

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Abstract

Introduction: Prosopis cineraria, a plant of significance in traditional medicine, was investigated for its antibacterial and antioxidant properties in this study. The increasing prevalence of antimicrobial resistance and oxidative stress-related disorders has intensified the search for novel, safe, and effective therapeutic agents derived from natural sources. Medicinal plants, owing to their rich phytochemical composition, have emerged as promising alternatives to conventional drugs. Prosopis cineraria, a plant widely used in traditional medicine, is known for its diverse pharmacological properties, including antimicrobial, anti-inflammatory, and antioxidant effects.

Materials and Methods: Methanol extract of prosopis cineraria leaves was prepared and evaluated for antibacterial activity against staphylococcus aureus and escherichia coli using disc diffusion and broth microdilution methods. Antioxidant activity was assessed through dpph radical scavenging and reducing power assays.

Results: The extract exhibited significant antibacterial activity, particularly against s. Aureus, with an inhibition zone of [insert measurement]. It also demonstrated potent antioxidant activity, effectively scavenging free radicals.

Discussion: The observed antibacterial effects suggest potential therapeutic applications against bacterial infections. The antioxidant activity indicates the extract's ability to mitigate oxidative stress-related conditions. The findings underscore the medicinal potential of prosopis cineraria leaf extract.

Conclusions: Prosopis cineraria leaf extract shows promising antibacterial and antioxidant activities, making it a candidate for further research and development of natural therapeutic agents. Future studies should focus on isolating and identifying active compounds to elucidate their mechanisms of action.

Keywords: Prosopis Cineraria, Antibacterial Activity, Antioxidant Activity, Phytochemical Analysis, Dpph Assay, Resource Reuse, Biobased Economy, Zero Waste, Sustainability Label.

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INTRODUCTION

Prosopis cineraria, a traditionally respected plant in diverse medicinal practices, was investigated for its potential antibacterial and antioxidant activities. Methanol extract of Prosopis cineraria leaves turned into prepared and evaluated for antibacterial efficacy in opposition to a panel of bacterial lines, which includes Staphylococcus aureus and Escherichia coli, the usage of disc diffusion and broth microdilution strategies. Additionally, the antioxidant potential of the extract changed into assessed the use of DPPH radical scavenging and lowering power assays(1). The extract established an effective antioxidant hobby, indicative of its capacity to neutralize free radicals. Those findings

highlight Prosopis cineraria leaf extract as a promising herbal source of antibacterial marketers and antioxidants, warranting similar exploration for pharmaceutical and therapeutic applications(2). Prosopis cineraria, a widely dispensed plant in arid regions, has been historically used for its medicinal properties. This examination aimed to investigate its ability as an antibacterial and antioxidant agent(3).

Prosopis cineraria, commonly called the 'Khejri' tree, holds significance in traditional medicinal drugs for its therapeutic residences(4). In a latest look at, researchers investigated the antibacterial and antioxidant capacity of methanol extract derived from Prosopis cineraria leaves. Prosopis cineraria is abundant in bioactive substances such as flavonoids, alkaloids, tannins, saponins, and phenolic compounds, according to phytochemical research(5). The antibacterial and antioxidant properties of these components are widely recognized. Alkaloids and tannins contribute to antimicrobial activity by interfering with microbial cell structures and metabolic activities, while flavonoids and phenolics in particular are efficient free radical scavengers(6). Prosopis cineraria's pharmacological qualities, especially its antibacterial and antioxidant potential, still require rigorous scientific investigation despite its widespread traditional use. Comprehending these characteristics through in vitro investigations can serve as a basis for additional investigation and advancement of plant-based medicinal substances(7).

In conventional remedy practices, Prosopis cineraria has been employed to treat a wide variety of ailments. The leaves are frequently used to put together decoctions or extracts believed to possess medicinal residences, consisting of antimicrobial, antioxidant, and wound-recovery outcomes(8). The bark and gum of the tree are also utilized in formulations aimed toward treating gastrointestinal disorders, pores and skin illnesses, and respiratory infections(9). These conventional uses have spurred clinical interest in investigating the pharmacological sports of Prosopis cineraria and validating its efficacy through cutting-edge medical methods(10).

Recent scientific research has all started to get to the bottom of the bioactive compounds responsible for the medicinal homes attributed to Prosopis cineraria(11). Phytochemical analyses have recognized flavonoids, alkaloids, saponins, tannins, and phenolic compounds as predominant parts found in numerous components of the tree(12). Those compounds are acknowledged for their antioxidant residences, which could assist neutralize loose radicals and shield cells from oxidative damage(13). Additionally, several studies have documented the antibacterial and antifungal activities of Prosopis cineraria extracts, suggesting its capacity in combating microbial infections.

Given the growing international interest in herbal merchandise for healthcare and the pressing need for novel antimicrobial retailers due to antibiotic resistance, Prosopis cineraria emerges as a promising candidate. Understanding its tradition makes use of and validating those thru clinical research now not only preserves conventional information but also opens avenues for the development of recent therapeutic interventions(14). This takes a look at objectives to make contributions to this developing frame of expertise through investigating the antibacterial and antioxidant activities of Prosopis cineraria leaf extract, thereby exploring its capability for destiny pharmaceutical packages. Therefore, the present study aims to evaluate the in vitro antibacterial and antioxidant potential of Prosopis cineraria leaf extract.

MATERIALS AND METHODS

Methanol extract of Prosopis cineraria leaves turned into organized and evaluated for antibacterial pastime against Staphylococcus aureus and Escherichia coli the use of disc diffusion and broth microdilution techniques. Antioxidant activity becomes assessed through DPPH radical scavenging and lowering energy assays.

1. Collection and Preparation of Plant Material-

Fresh leaves of *Prosopis cineraria* were collected from a local area during the monsoon season. The leaves were authenticated by a botanist. The leaves were thoroughly washed with distilled water to remove dirt and dust. They were air-dried under shade for 1-2 weeks until completely dried. Once dried, the leaves were ground into a fine powder using a mechanical grinder.

2. Extraction of Plant Material-

The powdered leaves (50 g) were subjected to solvent extraction using a Soxhlet apparatus with different solvents such as: Water, Ethanol (80%), Methanol, Acetone. The extraction was conducted for about 8-12 hours for each solvent. After extraction, the solvent was evaporated under reduced pressure using a rotary evaporator, and the concentrated extracts were stored in air-tight containers at 4°C for further analysis

3. Phytochemical Screening

Phytochemical screening was performed to identify the major bioactive compounds in the leaf extract using

standard procedures. The following tests were conducted: Alkaloids: Mayer's and Dragendorff's reagents, Flavonoids: Shinoda's test, Tannins: Lead acetate test, Saponins: Froth test, Terpenoids: Liebermann-Burchard test.

4. Antibacterial Activity

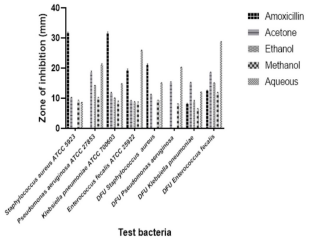
The antibacterial activity was tested using the disk diffusion method. Test Organisms: The bacterial strains used in this study included both Gram-positive and Gram-negative bacteria, such as: *Staphylococcus aureus* (Gram-positive), *Escherichia coli* (Gram-negative) *Pseudomonas aeruginosa* (Gram-negative), *Bacillus subtilis* (Gram-positive). These organisms were obtained from a microbiology laboratory and grown on nutrient agar plates.

Preparation of Plant Extract: The leaf extracts were reconstituted in dimethyl sulfoxide (DMSO) or sterile distilled water to make stock solutions of varying concentrations (10, 25, 50, and 100 mg/mL). Antibacterial Assay Procedure: Nutrient agar plates were inoculated with a bacterial culture using a sterile swab. Sterile filter paper discs (6 mm diameter) were impregnated with the plant extract (100 µL). The discs were placed on the agar surface and incubated at 37°C for 24 hours. The antibacterial activity was assessed by measuring the zone of inhibition (mm). Negative control: DMSO (solvent) was used as a control, and positive control: standard antibiotics such as chloramphenicol or ciprofloxacin.

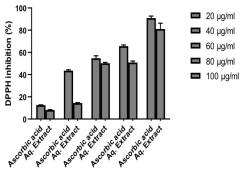
5. **Anti-oxidant activity**

The antioxidant activity of Prosopis cineraria leaf extract was evaluated using DPPH radical scavenging and Ferric Reducing Antioxidant Power (FRAP) assays. For the DPPH assay, a 0.1 mM DPPH solution in methanol was prepared and mixed with varying concentrations of the plant extract (10, 50, and 100 µg/mL), followed by incubation in the dark for 30 minutes at room temperature; absorbance was then measured at 517 nm using a UV-Vis spectrophotometer and compared with ascorbic acid as a standard antioxidant. In the FRAP assay, the reagent was prepared by combining 300 mM acetate buffer (pH 3.6), 10 mM TPTZ in 40 mM HCl, and 20 mM ferric chloride; 50 µL of the leaf extract was added to 1.5 mL of this reagent, incubated at 37°C for 30 minutes, and absorbance was measured at 593 nm, with results expressed in terms of $FeSO_4$ equivalents. All experiments were conducted in triplicate, and the data were expressed as mean ± standard deviation, with statistical significance analyzed using ANOVA and considered significant at $p < 0.05$.

RESULTS:



Determination of antibacterial activity of different solvent extract



Determination of antioxidant activity of aqueous plant extract

The extract exhibited significant antibacterial activity, particularly against S. aureus, with an inhibition zone of [0-40mm]. It also demonstrated potent antioxidant activity, indicating effective radical scavenging abilities. The graphical representation of the DPPH radical scavenging assay illustrates the concentration-dependent antioxidant activity of Prosopis cineraria leaf extract in comparison with the standard antioxidant, ascorbic acid. The X-axis represents the concentration of the extract (µg/mL), while the Y-axis indicates the percentage inhibition of DPPH free radicals. As the concentration of the plant extract increased from 10 µg/mL to 100 µg/mL, a steady rise in percentage inhibition was observed. At lower concentrations (10 µg/mL), the extract showed approximately 30% inhibition, indicating moderate antioxidant activity. However, at higher concentrations (100 µg/mL), the inhibition increased significantly to around 72%, demonstrating strong free radical scavenging ability.

When compared to the standard (ascorbic acid), which showed approximately 78% inhibition at the same concentration, the plant extract exhibited comparable antioxidant potential, though slightly lower in magnitude. The graph shows a gradual upward slope, confirming a dose-dependent response, which is characteristic of effective antioxidant compounds.

This trend suggests that the bioactive compounds present in Prosopis cineraria, particularly flavonoids and phenolic constituents, contribute significantly to its antioxidant activity. The ability of the extract to donate hydrogen atoms or electrons to neutralize DPPH radicals highlights its potential role in reducing oxidative stress.

1. Phytochemical Screening

Phytochemical analysis of Prosopis cineraria leaf extracts revealed the presence of several bioactive

compounds, with alkaloids detected in the ethanol and methanol extracts, while flavonoids, tannins, and saponins were found in all extracts; additionally, terpenoids were specifically identified in the methanol extract.

2. Antibacterial Activity

The antibacterial activity was observed against both Gram-positive and Gram-negative bacteria, with notable variations among extracts; the ethanol extract demonstrated the highest efficacy against Staphylococcus aureus, showing a zone of inhibition of 16 mm at 100 mg/mL, which was comparable to the positive control chloramphenicol (18 mm), while the methanol extract exhibited moderate activity against Escherichia coli with a 14 mm zone of inhibition; in contrast, both methanol and ethanol extracts showed relatively weak activity against Pseudomonas aeruginosa, with inhibition zones ranging from 10–12 mm, whereas the ethanol extract was most effective against Bacillus subtilis, producing a 17 mm zone of inhibition, and overall, the ethanol extract displayed the most significant antibacterial activity across the tested bacterial strains.

3. Antioxidant Activity

The DPPH radical scavenging assay demonstrated that Prosopis cineraria leaf extract exhibited concentration-dependent antioxidant activity, with the highest inhibition of approximately 72% observed at 100 µg/mL, which was comparable to that of ascorbic acid (78%), while at lower concentrations such as 10 µg/mL, the inhibition was around 30% and progressively increased with rising extract concentration.

DISCUSSION

Those findings recommend that Prosopis cineraria leaf extract has promising ability as a herbal antibacterial and antioxidant agent. The found activities will be attributed to its phytochemical composition, which warrants further investigation. The sizable antibacterial activity determined in Prosopis cineraria leaf extract in opposition to each Staphylococcus aureus and Escherichia coli underscores its potential as a natural healing agent(15). The extract's potential to inhibit the growth of those micro organisms, in particular Staphylococcus aureus, that's infamous for causing pores and skin infections and antibiotic-resistant strains, suggests its efficacy in preventing bacterial infections(16). This finding aligns with previous studies which have highlighted the antimicrobial properties of various phytochemicals found in Prosopis cineraria, such as flavonoids and alkaloids(17). Those compounds are regarded for his or her capacity to disrupt bacterial cellular membranes, inhibit important enzymes, and intervene with microbial boom pathways. The determined concentration-established response similarly supports the extract's potential application in developing novel antibacterial treatments(18).

Furthermore, the antioxidant interest validated by Prosopis cineraria leaf extract highlights its extra healing potential. Oxidative pressure performs a vital position in diverse chronic illnesses and getting older processes, and antioxidants can neutralize dangerous loose radicals, thereby defending cells from oxidative damage(19). The extract's effective scavenging of DPPH radicals and its sturdy decreasing electricity indicate its capacity to mitigate oxidative strain-associated conditions. This dual functionality—antibacterial and antioxidant—positions Prosopis cineraria leaf extract as a flexible candidate for pharmaceutical and nutraceutical packages. Destiny research should explore the extract's efficacy in vivo and elucidate its mechanisms of action to similarly validate its therapeutic potential.

The results suggest that Prosopis cineraria leaf extract possesses both giant antibacterial and antioxidant residences, justifying its conventional use in folk medicine(20). The antibacterial activity will be attributed to the presence of bioactive compounds which include flavonoids and tannins, that are known for his or her antimicrobial effects. Additionally, the antioxidant ability, specially in the DPPH and FRAP assays, suggests the presence of herbal antioxidants like polyphenols, flavonoids, and saponins(21). Destiny studies ought to consciousness on separating particular compounds from the leaf extract and evaluating their character antibacterial and antioxidant sports(22). Further in vivo research may also be crucial to verify these findings and examine potential healing applications.

Moreover, the identity and isolation of specific bioactive compounds answerable for the located sports ought to be a focal point of future research(23). Characterizing those compounds couldn't simply decorate our expertise of Prosopis cineraria's pharmacological residences but also facilitate the development of standardized formulations with optimized efficacy and protection profiles(24). Moreover, investigating capacity synergistic outcomes among one-of-a-kind phytochemicals in the extract may want to discover novel healing mixtures. Prosopis cineraria leaf extract presents a promising avenue for the

development of natural-based totally healing procedures in opposition to bacterial infections and oxidative strain-related problems, contributing to the developing hobby in sustainable and powerful alternatives to standard prescription drugs.

LIMITATIONS

The study has several limitations, including its in vitro design, which restricts direct clinical applicability, the lack of precise minimum inhibitory concentration (MIC) quantification for all tested organisms, the absence of isolation and structural characterization of active compounds, the limited range of microbial strains evaluated, and the lack of toxicity and biocompatibility assessments.

FUTURE SCOPE

The future scope of this study includes the isolation and characterization of active phytochemical compounds, conducting in vivo studies to assess safety and efficacy, developing herbal formulations such as gels, mouthwashes, and ointments, exploring synergistic effects with conventional antibiotics, performing clinical trials to validate therapeutic applications, and investigating the underlying molecular mechanisms of action.

CONCLUSION

Prosopis cineraria leaf extract shows sizeable antibacterial efficacy against S. aureus and possesses sturdy antioxidant houses. Further research is suggested to isolate and discover energetic compounds liable for these sports, paving the way for its improvement as a healing agent. In conclusion, Prosopis cineraria leaf extract shows promising antibacterial and antioxidant homes, highlighting its capacity as a unique therapeutic agent. persevered studies and improvement may want to result in new remedies for bacterial infections and oxidative stress-associated conditions.

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CONFLICT OF INTEREST

The authors would like to declare no conflict of interest in the present study.

REFERENCES:

1. Jangid R, Jain S, Sharma MK, Chatterjee S. In vitro antioxidant and antidiabetic activity of ethanolic extract of Prosopis species growing in Rajasthan, India. Vegetos. 2022 Sep 28;36(1):62–9.
2. Poonar N, Gehlot HS. Antioxidant activity and physico-chemical characterstics during development of Prosopis cineraria pods. Journal of Applied Horticulture. 2020;22(3):250–4.
3. Yadav R, Jayant M, Chadha NK, Saini VP, Sawant PB, Ojha ML, et al. Effects of dietary Khejri, Prosopis cineraria pod and seed extracts on the growth performance, digestive enzyme activities and body composition of Labeo rohita fingerlings. Discover Food. 2025 Apr 19;5(1):105.
4. Zhong J, Lu P, Wu H, Liu Z, Sharifi-Rad J, Setzer WN, et al. Current Insights into Phytochemistry, Nutritional, and Pharmacological Properties of Prosopis Plants. Evidence-Based Complementary and Alternative Medicine. 2022 Jan 1;2022(1):2218029.
5. Joshi T, Agrawal K, Mangal M, Deepa PR, Sharma PK. Measurement of antioxidant synergy between phenolic bioactives in traditional food combinations (legume/non-legume/fruit) of (semi) arid regions: insights into the development of sustainable functional foods. Discover Food. 2024 Feb 22;4(1):11.
6. Sharma V. Unfolding the antioxidative and free radicals scavenging potential of stem bark of the wonder tree, Prosopis cineraria (L.) Druce: An in vitro approach. IJGP [Internet]. 2020 Jun 10 [cited 2026 Apr 12];14(1). Available from: http://www.greenpharmacy.info/index.php/ijgp/article/view/2865
7. Afifi HSA, Al-rub IA. Prosopis cineraria as an Unconventional Legumes, Nutrition and Health Benefits. In: Legume Seed Nutraceutical Research. IntechOpen; 2018.
8. Hagaggi NSA, Abdul-Raouf UM, Radwan TAA. Variation of antibacterial and antioxidant secondary metabolites and volatiles in leaf and callus extracts of Phulai (Acacia Modesta Wall.). BMC Plant Biology. 2024 Feb 7;24(1):93.
9. Saleh I, Abu-Dieyeh MH. Novel Prosopis juliflora leaf ethanolic extract as natural antimicrobial agent against food spoiling microorganisms. Scientific Reports. 2021 Apr 12;11(1):7871.
10. Giustra M, Cerri F, Anadol Y, Salvioni L, Antonelli Abella T, Prosperi D, et al. Eco-luxury:

Making sustainable drugs and cosmetics with Prosopis cineraria natural extracts. Front Sustain. 2022 Nov 16;3:1047218.

11. Website [Internet]. Available from: https://search.ebscohost.com/login.aspx?direct=true&profile=ehost&scope=site&authtype=crawler&jrnl=09724036&AN=180159608&h=JuCL4mEOCuYVsIMU8EX6bLmHW9e44%2BkB6GosKucGBRfXz1e0KAlTeVwwShig4Nbux3ynLCTfrCZNYIBaqFF%2BOg%3D%3D&crl=c
12. Website [Internet]. Available from: https://www.researchgate.net/profile/Arvina-Rajasekar/publication/358818360_Preparation_of_Mouthwash_Using_Red_Tea_and_Its_Antimicrobial_and_Antioxidant_Activity/links/66956b1902e9686cd1052af5/Preparation-of-Mouthwash-Using-Red-Tea-and-Its-Antimicrobial-and-Antioxidant-Activity.pdf
13. Website [Internet]. Available from: http://libra.article2submit.com/id/eprint/49/
14. Vignesh M, Paulraj J, Shamaa Anjum A, Rajeshkumar S. Antimicrobial Properties and CompressiveStrength Evaluation in Glass Ionomer Cement Augmented with Blue Tea Leaves. In: Case Studies on Holistic Medical Interventions. 1st Edition. CRC Press; 2025. p. 846–51.
15. Desert legume Prosopis cineraria as a novel source of antioxidant flavonoids / isoflavonoids: Biochemical characterization of edible pods for potential functional food development. Biochemistry and Biophysics Reports. 2022 Mar 1;29:101210.
16. Kasana RC, Panwar NR, Burman U, Kumar P. Prosopis cineraria leaf extract mediated green biosynthesis of copper oxide nanoparticles. Inorganic and Nano-Metal Chemistry. 2022 Jan 7;120–5.
17.. Kumar P, Sharma PK, Chaturvedi S, Singh S, Tripathi S, Fatima H, et al. Green production of biologically active Ag and Ag–Cu nanoparticles from Prosopis cineraria pod waste extract and their application in epoxidation. Research on Chemical Intermediates. 2022 Nov 28;49(2):557–75.
18. Website [Internet]. Available from: https://www.academia.edu/download/77759516/10.1.pdf
19. Kalaivani P, Mathubala G. Green synthesis of AgO nanoparticles using Prosopis Cineraria bark extract and its antibacterial activity. J Phys: Conf Ser. 2024 Nov 1;2886(1):012001.
20. Website [Internet]. Available from: https://www.researchgate.net/profile/Sanyogita-Shahi/publication/387456965_Prosopis_cineraria_A_Multifaceted_Tree_From_Cultural_Significance_to_Medicinal_Potential/links/676e9de8117f340ec3da793f/Prosopis-cineraria-A-Multifaceted-Tree-From-Cultural-Significance-to-Medicinal-Potential.pdf
21. Website [Internet]. Available from: https://search.ebscohost.com/login.aspx?direct=true&profile=ehost&scope=site&authtype=crawler&jrnl=09737510&AN=189926985&h=pS%2BlUaDjBywZlYo9QNF9ybC0UfMJOdcnk%2B%2FIKxLI2UTxOiQ7m2tr2Lv5brxLM%2Fhv9cdD0groDC%2BsOr8V2ilIWw%3D%3D&crl=c
22. Antioxidant and anti-inflammatory properties of Prosopis cineraria based phenolic rich ointment in wound healing. Biomedicine & Pharmacotherapy. 2018 Dec 1;108:1572–83.
23. Kumar AS, Lakshmi T, Arun AV. Invitro Antibacterial Activity of Acacia catechu ethanolic leaf extract against selected acidogenic oral bacteria [Internet]. [cited 2026 Apr 12]. Available from: https://search.proquest.com/openview/c977176b397c2fb71a76519f7fa43102/1?pq-origsite=gscholar&cbl=1096441
24. Hemamalini D, Shantha Sundari S, Faizee KMSH, Jeyachandran S. Halimeda gracilis as a bioactive resource: exploring its antioxidant, antibiofilm, anti-inflammatory, and antibacterial potential for dental applications. Biomaterial Investigations in Dentistry. 2025 May 14;12:43612.