

Pharmacological and Natural Effects of In-Vitro Antioxidant Activity of *Leucas aspera* Leaf Extract

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ABSTRACT:

Aim:The present study aimed to evaluate the in-vitro antioxidant activity of *Leucas aspera* leaf extract and to assess its pharmacological and natural therapeutic potential.

Introduction:Oxidative stress caused by free radicals plays a major role in the development of chronic diseases. Natural antioxidants from medicinal plants are gaining importance due to their safety and efficacy. *Leucas aspera*, traditionally used in herbal medicine, contains bioactive compounds that may contribute to its antioxidant properties.

Materials and Methods:Leaves of *Leucas aspera* were collected, dried, and extracted using ethanol. The antioxidant activity was assessed using DPPH and hydrogen peroxide scavenging assays at different concentrations (20–100 µg/mL). Ascorbic acid was used as the standard. Absorbance was measured spectrophotometrically, and percentage inhibition was calculated.

Results and Discussion:The extract demonstrated significant dose-dependent antioxidant activity in both assays. Although slightly lower than the standard, the extract showed considerable free radical scavenging ability. This activity is attributed to phytochemicals such as flavonoids and phenolic compounds. The findings support the plant's pharmacological relevance and validate its traditional use.

Conclusion:*Leucas aspera* leaf extract exhibits promising antioxidant activity, indicating its potential as a natural therapeutic agent. Further studies are recommended to explore its clinical applications....

Keywords: *Leucas aspera*, antioxidant activity, DPPH assay, hydrogen peroxide scavenging, phytochemicals, medicinal plants.

INTRODUCTION

Medicinal plants have long served as a cornerstone in traditional healthcare systems, offering a wide range of therapeutic benefits. Among these, antioxidant-rich plants have gained considerable attention due to their ability to neutralize free radicals and prevent oxidative stress.(1) Oxidative stress is implicated in the pathogenesis of numerous chronic diseases, including cardiovascular disorders, cancer, and neurodegenerative conditions. (1,2)Therefore, identifying plant-based antioxidants is essential for developing safer and more effective therapeutic agents that can complement or replace synthetic compounds currently in use.

Leucas aspera, a widely distributed herb in tropical regions, has been traditionally used in folk medicine for treating inflammation, skin infections, and respiratory disorders. The plant is known to contain various bioactive compounds such as flavonoids, phenolics, alkaloids, and terpenoids(3). These constituents are believed to

contribute to its pharmacological properties. Despite its extensive traditional use, scientific validation of its antioxidant potential remains crucial to understand its mechanism of action and therapeutic relevance in modern medicine.(3,4)

Antioxidants play a critical role in maintaining cellular homeostasis by scavenging reactive oxygen species (ROS) and preventing cellular damage. In-vitro antioxidant assays provide a controlled environment to evaluate the free radical scavenging ability of plant extracts. These assays(5), including DPPH and hydrogen peroxide scavenging methods, are widely used due to their simplicity, reliability, and reproducibility. Investigating the antioxidant activity of *Leucas aspera* leaf extract through such assays helps establish its potential as a natural source of therapeutic antioxidants.(4,5)

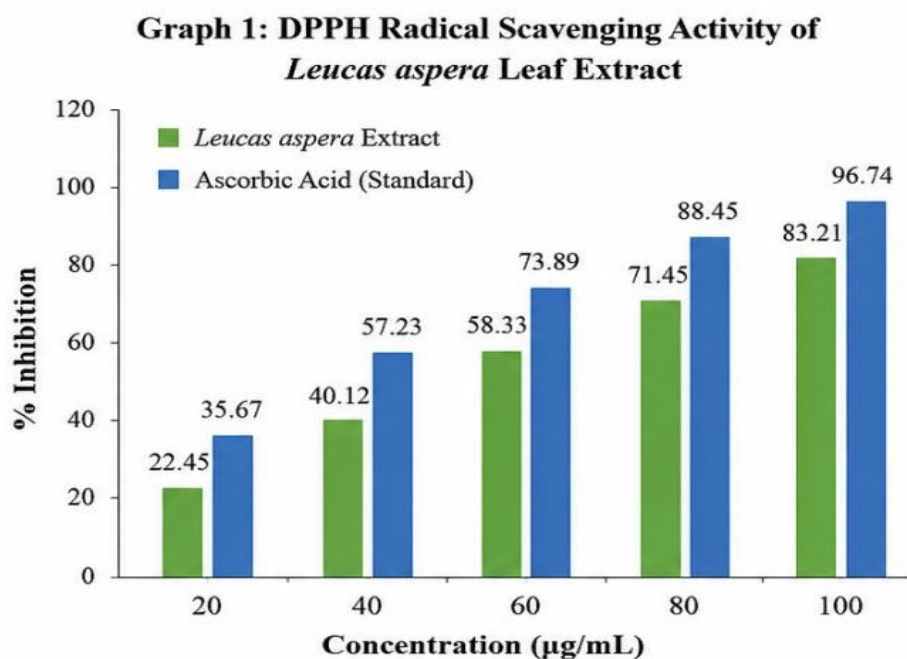
Natural antioxidants derived from plant sources are increasingly preferred over synthetic ones due to their lower toxicity and better compatibility with biological systems. The pharmacological effects of these compounds extend beyond antioxidant activity, including anti-inflammatory, antimicrobial, and wound healing properties.(4–6) *Leucas aspera* leaf extract, with its diverse phytochemical composition, may exhibit multiple beneficial effects that contribute to overall health. Understanding these natural effects is essential for exploring its applications in pharmaceutical and nutraceutical formulations.(7)

This study aims to evaluate the in-vitro antioxidant activity of *Leucas aspera* leaf extract and to explore its pharmacological significance. By assessing its free radical scavenging potential, the research seeks to provide scientific evidence supporting its traditional use. Additionally, the study highlights the importance of plant-based antioxidants in reducing oxidative stress and promoting health. The findings may contribute to the development of novel therapeutic agents derived from natural sources, emphasizing the relevance of herbal medicine in contemporary healthcare practices.

MATERIALS AND METHODS:

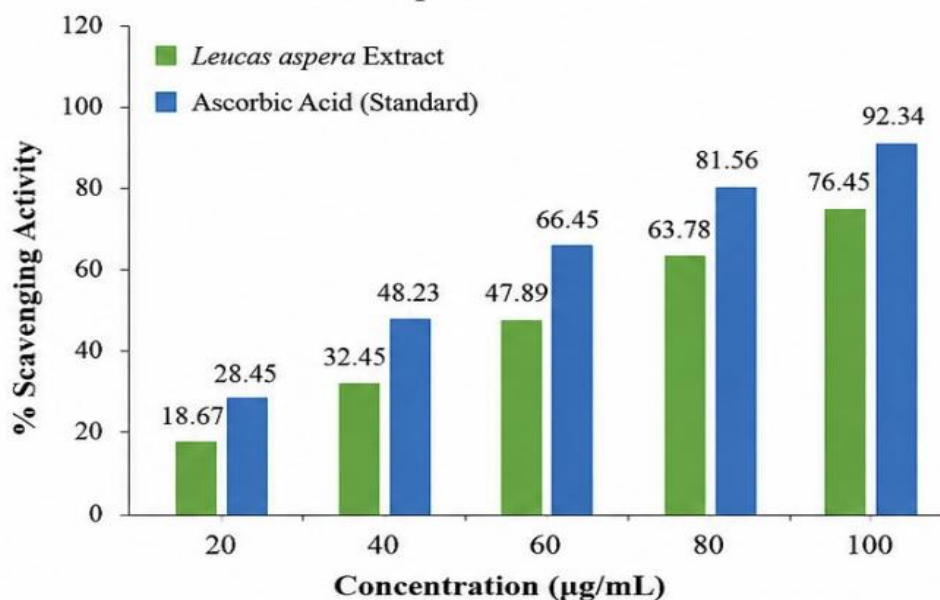
Fresh leaves of *Leucas aspera* were collected, washed, shade-dried, and powdered. The extract was prepared using ethanol via Soxhlet extraction. Antioxidant activity was assessed using DPPH radical scavenging assay and hydrogen peroxide scavenging assay at varying concentrations (20–100 µg/mL). Ascorbic acid was used as a standard. Absorbance was measured using a UV spectrophotometer, and percentage inhibition was calculated.

RESULTS



The DPPH assay revealed a concentration-dependent increase in the free radical scavenging activity of *Leucas aspera* leaf extract. At 100 µg/mL, the extract showed 83.21% inhibition, while the standard ascorbic acid showed 96.74% inhibition. The extract exhibited moderate to strong antioxidant activity, which may be due to the presence of phenolics, flavonoids, and other bioactive compounds capable of donating hydrogen atoms or electrons to neutralize free radicals. The results indicate that the extract has a significant potential as a natural antioxidant source.

Graph 2: Hydrogen Peroxide Scavenging Activity of *Leucas aspera* Leaf Extract



The hydrogen peroxide scavenging assay also showed a dose-dependent increase in activity. At 100 µg/mL, the extract exhibited 76.45% scavenging activity, compared to 92.34% for ascorbic acid. This shows that the extract can effectively neutralize hydrogen peroxide, thereby reducing oxidative stress. The presence of flavonoids and phenolic compounds in the extract may contribute to this activity by breaking the chain reactions of reactive oxygen species. The results confirm the antioxidant potential of *Leucas aspera* leaf extract.

DISCUSSION

The findings of this study indicate that *Leucas aspera* leaf extract exhibits significant antioxidant activity in vitro. The observed free radical scavenging ability can be attributed to the presence of phytochemicals such as flavonoids and phenolic compounds. (8) These bioactive molecules are known for their capacity to donate electrons or hydrogen atoms, thereby neutralizing reactive oxygen species. The results align with previous studies that emphasize the importance of plant-derived antioxidants in reducing oxidative stress and preventing cellular damage associated with various chronic diseases. (8,9)

The dose-dependent increase in antioxidant activity observed in both assays suggests that higher concentrations of the extract enhance its efficacy. This indicates a direct relationship between phytochemical content and antioxidant potential. (10) The extract's performance, although slightly lower than the standard, demonstrates its capability as a natural alternative to synthetic antioxidants. Such natural compounds are often preferred due to their reduced toxicity and better compatibility with biological systems, making them suitable for long-term therapeutic use. (11)

The pharmacological effects of *Leucas aspera* extend beyond antioxidant activity. Its anti-inflammatory and antimicrobial properties further support its role in promoting overall health (4). By reducing oxidative stress, the extract may indirectly contribute to improved immune function and tissue repair. These combined effects highlight the therapeutic versatility of the plant. The integration of such natural compounds into modern medicine could provide a holistic approach to disease management and prevention.

The results also emphasize the importance of validating traditional medicinal plants through scientific research. While *Leucas aspera* has been widely used in folk medicine, studies like this provide evidence-based support for its efficacy. This helps bridge the gap between traditional knowledge and modern pharmacology. Furthermore, the identification of specific active compounds within the extract could lead to the development of targeted therapies and pharmaceutical formulations. (4,12)

Despite promising results, further research is necessary to explore the full potential of *Leucas aspera*. In-vivo studies and clinical trials are required to confirm its safety and effectiveness in humans. Additionally, isolating and characterizing individual bioactive compounds will enhance understanding of its mechanisms of action.

Overall, the study supports the potential of *Leucas aspera* as a natural antioxidant source, encouraging continued research into plant-based therapeutics for improved healthcare outcomes.

Conclusion:

The present study demonstrates that *Leucas aspera* leaf extract possesses significant in-vitro antioxidant activity, as evidenced by DPPH and hydrogen peroxide scavenging assays. The activity is concentration-dependent and attributable to phytochemicals such as flavonoids and phenolics. These findings support its pharmacological relevance and validate its traditional use as a natural, safe, and effective antioxidant source for potential therapeutic applications.

Future Scope:

Further research should focus on in-vivo studies and clinical trials to confirm the efficacy and safety of *Leucas aspera* leaf extract in humans. Isolation and characterization of active compounds are essential to understand mechanisms of action. Additionally, formulation into drugs or nutraceuticals could be explored, along with its potential role in managing oxidative stress-related diseases.

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