European Journal of Clinical Pharmacy
Print ISSN: 2385-409X **Online ISSN**: 3105-0409
Website: https://farmclin.com/

Original Research Article

Exploring the Therapeutic Potential of Monstera deliciosa Fruit: Phytochemical Composition, Antioxidant Capacity, and Antimicrobial Activity

Article History:

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Received: 28-11-2025
Revised: 05-12-2025
Accepted: 12-01-2026
Published: 28-01-2026

Abstract: Medicinal plants continue to play a crucial role in drug discovery due to their rich reservoir of bioactive phytochemicals. Monstera deliciosa (family: Araceae), although widely cultivated as an ornamental plant and consumed for its edible fruit, remains underexplored for its pharmacological potential. The present study aims to evaluate the phytochemical composition, antioxidant capacity, and antimicrobial activity of M. deliciosa fruit extracts prepared using chloroform, ethyl acetate, ethanol, methanol, and aqueous solvents. Soxhlet extraction was employed, followed by qualitative and quantitative phytochemical screening using standard protocols. In vitro antioxidant activity was assessed using DPPH, ABTS, and FRAP assays at concentrations of 20, 30, and 40 µg/mL. Antimicrobial activity was evaluated against selected bacterial and fungal strains using the disc diffusion method. The results revealed the presence of diverse bioactive compounds including alkaloids, flavonoids, tannins, saponins, phenols, terpenoids, steroids, and glycosides. Ethyl acetate extracts exhibited superior antioxidant activity in DPPH and ABTS assays, while aqueous extracts showed higher ferric reducing power. These findings suggest that M. deliciosa fruit is a promising source of natural antioxidants and antimicrobial agents, supporting its potential therapeutic applications.

Keywords: Monstera deliciosa, phytochemicals, antioxidant activity, antimicrobial activity, Soxhlet extraction, medicinal plants.

INTRODUCTION

Plants have served as a cornerstone of traditional medicine systems for thousands of years and continue to be an invaluable source of novel therapeutic agents. According to the World Health Organization, nearly 80% of the global population relies on plant-based medicines for primary healthcare. The Indian herbal medicine sector, particularly Ayurveda, Siddha, and Unani systems, has witnessed substantial growth, with an estimated annual expansion rate of approximately 20%. This increasing demand underscores the need for scientific validation of traditionally used and underutilized medicinal plants [1-3].

Phytochemicals such as alkaloids, flavonoids, tannins, phenols, terpenoids, and saponins are known to exhibit a wide range of biological activities including antioxidant, antimicrobial, anti-inflammatory, and anticancer effects. Oxidative stress caused by free radicals is implicated in the pathogenesis of several chronic diseases such as cancer, cardiovascular disorders, neurodegenerative diseases, and diabetes. Natural antioxidants derived from plant sources are therefore gaining attention as safer alternatives to synthetic antioxidants [4-7]. Monstera deliciosa, commonly known as the fruit salad plant, belongs to the family Araceae and is widely grown as an ornamental plant due to its distinctive perforated leaves. The fruit of M. deliciosa is edible, aromatic, and rich in nutrients such as potassium and vitamin C, with a characteristic flavor resembling pineapple and banana. Despite its nutritional value, the medicinal and pharmacological properties of M. deliciosa fruit remain inadequately explored.

Previous studies have reported the presence of bioactive compounds in M. deliciosa leaves and fruits, along with antioxidant, antibacterial, and anticancer activities. Notably, M. deliciosa extracts have demonstrated significant anticancer activity in Ehrlich

ascites carcinoma-induced Swiss albino mice, and have also been utilized in the green synthesis of gold nanoparticles. However, comprehensive phytochemical profiling and comparative evaluation of antioxidant activity across different solvent extracts of the fruit are limited [7-10].

The present study aims to bridge this knowledge gap by systematically evaluating the phytochemical constituents, antioxidant potential, and antimicrobial activity of M. deliciosa fruit extracts using multiple solvents, thereby providing scientific evidence for its therapeutic potential.

MATERIALS AND METHODS

2.1 Collection and Authentication of Plant Material

Fresh fruits of Monstera deliciosa were collected from the Kanyakumari district, Tamil Nadu, India. The fruits were washed thoroughly with distilled water to remove surface impurities, shade-dried at room temperature, and pulverized into a coarse powder using a mechanical grinder.

2.2 Preparation of Extracts

The powdered fruit material was subjected to Soxhlet extraction using chloroform, ethyl acetate, ethanol, methanol, and distilled water as solvents. Each extraction was carried out for 6 -8 hours until the solvent in the siphon tube became colorless. The extracts were concentrated under reduced pressure and stored at 4 °C for further analysis.

2.3 Qualitative Phytochemical Screening

Standard phytochemical tests were performed to detect the presence of alkaloids, flavonoids, tannins, phenols, saponins, glycosides, terpenoids, steroids, proteins, and carbohydrates following established protocols.

2.4 Quantitative Phytochemical Analysis

Quantitative estimation of major phytochemicals such as alkaloids, flavonoids, tannins, phenols, saponins, and proteins was carried out using spectrophotometric methods. Results were expressed as µg/mL of extract.

2.5 In Vitro Antioxidant Assays

2.5.1 DPPH Radical Scavenging Assay

The free radical scavenging activity of the extracts was evaluated using the DPPH assay at concentrations of 20, 30, and 40 µg/mL. Ascorbic acid was used as a standard.

2.5.2 ABTS Radical Cation Decolorization Assay

ABTS assay was performed to determine the ability of extracts to scavenge $ABTS^{\bullet+}$ radicals, with results compared to ascorbic acid.

2.5.3 Ferric Reducing Antioxidant Power (FRAP) Assay

The reducing power of the extracts was assessed by the FRAP assay, measuring the conversion of ferric (Fe^{3+}) to ferrous (Fe^{2+}) ions.

2.6 Antimicrobial Activity

Antimicrobial activity was evaluated using the disc diffusion method against bacterial strains (Escherichia coli, Staphylococcus aureus, Streptococcus mutans, Klebsiella pneumoniae, Enterococcus faecalis) and fungal strains (Aspergillus niger, Aspergillus flavus, Penicillium notatum). Zones of inhibition were measured in millimeters.

RESULTS AND DISCUSSION

3.1 Qualitative Phytochemical Screening

The qualitative phytochemical analysis of Monstera deliciosa fruit extracts prepared using chloroform, ethyl acetate, ethanol, methanol, and aqueous solvents revealed the presence of a diverse range of secondary metabolites (Table 1). Terpenoids, glycosides, steroids, and carbohydrates were detected in all five extracts, indicating that these compounds are widely distributed in the fruit matrix and possess broad solvent solubility. Alkaloids and saponins were found exclusively in the aqueous extract, suggesting that these compounds are predominantly polar in nature. This observation aligns with previous studies reporting higher extraction efficiency of alkaloids and saponins in polar solvents such as water due to their ionic and hydrophilic characteristics [11,12]. Tannins and proteins were detected mainly in ethanol and methanol extracts, reflecting the ability of alcoholic solvents to efficiently solubilize polyphenolic and nitrogen-containing compounds. Flavonoids and phenolic compounds were prominent in ethyl acetate and aqueous extracts, which is consistent with earlier reports indicating that moderately polar solvents are optimal for flavonoid extraction. The presence of these phytochemical classes is pharmacologically significant, as flavonoids and phenols are well-known antioxidants, alkaloids exhibit antimicrobial and anticancer properties, and saponins contribute to membrane-disrupting and immunomodulatory effects. The broad phytochemical diversity observed in M. deliciosa fruit suggests its potential as a multifunctional therapeutic agent.

3.2 Quantitative Phytochemical Analysis

Quantitative estimation of phytochemicals demonstrated considerable variation in compound concentration across different solvent extracts (Table 2). The aqueous extract exhibited the highest alkaloid content (774.12 ± 0.617 µg/mL), followed by significant saponin concentration (549.27 ± 0.991 µg/mL). This confirms the qualitative findings and highlights water as an effective solvent for extracting polar bioactive constituents.

Flavonoid content was remarkably high in the aqueous (4919.86 ± 0.727 µg/mL) and ethyl acetate (3444.54 ± 0.485 µg/mL) extracts, suggesting that M. deliciosa fruit is a rich source of flavonoid compounds. These high flavonoid levels are particularly important, as flavonoids are strongly correlated with antioxidant, anti-inflammatory, and anticancer activities. Phenolic content was also substantial in ethyl acetate (790.42 ± 0.163 µg/mL) and aqueous (870.62 ± 0.273 µg/mL) extracts, reinforcing their role in redox-related biological functions.

Tannins and proteins were predominantly found in ethanol and methanol extracts, with methanol showing slightly higher protein content (340.22 ± 0.960 µg/mL) than ethanol (320.67 ± 0.009 µg/mL). These results suggest that alcoholic solvents are more efficient in extracting mid-polar biomolecules. The quantitative data collectively indicate that solvent polarity plays a decisive role in determining phytochemical yield and composition.

Phytochemical constituent	Chloroform	Ethyl acetate	Ethanol	Methanol	Aqueous
Alkaloid	_	_	_	_	+
Flavonoid	_	+	_	_	+
Tannin	_	_	+	+	_
Phenol	_	+	_	_	+
Saponin	_	_	_	_	+
Terpenoids	+	+	+	+	+
Glycoside	+	+	+	+	+
Steroids	+	+	+	+	+
Carbohydrate	+	+	+	+	+
Protein	_	_	+	+	_

Table 1. Qualitative analysis of chloroform, ethyl acetate, ethanol methanol and aqueous extract of M. deliciosa fruit.

Table.2. Quantitative analysis of chloroform, ethyl acetate, ethanol, methanol and aqueous extract of M. deliciosa fruit (MD)

Phytochemical constituent	MD				
	Chloroform	Ethyl acetate	Ethanol	Methanol	Aqueous
Alkaloid	_	_	_	_	774.12 ± 0.617
Flavonoid	_	3444.54 ± 0.485	_	_	4919.86 ± 0.727
Tannin	_	_	36.53 ± 0.073	68.29 ± 0.277	_
Phenol	_	790.42 ± 0.163	_	_	870.62 ± 0.273
Saponin	_	_	_	_	549.27 ± 0.991
Glycoside	460.62 ± 0.281	348.72 ± ± 0.068	72.91 ± 0.035	90.85 ± 0.016	1104.59 ± 0.242
Terpenoids	3.26 ± 0.018	14.68 ± 0.032	10.65 ± 0.024	5.86 ± 0.004	49.8 ± 0.043
Steroid	20.27 ± 0.008	4.65 ± 0.008	17.49 ± 0.026	18.32 ± 0.006	8.87 ± 0.002

Carbohydrate	155.60 ± 0.817	81.64 ± 0.018	18.64 ± 0.004	60.75 ± 0.009	175.03 ± 0.472
Protein	_	_	320.67 ± 0.009	340.22 ± 0.960	_

3.3 In Vitro Antioxidant Activity

3.3.1 DPPH Radical Scavenging Activity

The DPPH assay revealed a concentration-dependent increase in radical scavenging activity across all extracts at 20, 30, and 40 µg/mL (Table 3). Among the tested extracts, the ethyl acetate extract demonstrated the highest DPPH radical scavenging activity, approaching that of the standard antioxidant ascorbic acid at higher concentrations. This superior activity can be attributed to the high flavonoid and phenolic content of the ethyl acetate extract, which effectively donate hydrogen atoms to stabilize DPPH free radicals [13].

Table 3. In vitro DPPH radical scavenging activity of M. deliciosa fruit (MD) at different solvents and concentrations compared with standard ascorbic acid

Concentration	MD					
	Chloroform	Ethyl acetate	Ethanol	Methanol	Aqueous	Standard
20 µg/ ml	28.46 ± 0.076	45.33 ± 0.041	31.85 ± 0.033	17.49 ± 0.033	4.63 ± 0.011	36.69 ± 0.299
30 µg/ ml	30.86 ± 0.036	55.10 ± 0.025	33.39 ± 0.054	18.33 ± 0.049	6.67 ± 0.090	58.442 ± 0.113
40 µg/ ml	33.62 ± 0.025	63.16 ± 0.010	35.23 ± 0.018	19.34 ± 0.003	10.14 ± 0.081	64.967 ± 3.078
IC 50 Value	103.721	24.9187	127.692	371.766	185.547	27.619

The aqueous extract also exhibited notable scavenging activity, albeit slightly lower than ethyl acetate, while chloroform extracts showed comparatively weaker activity. The lower antioxidant potential of non-polar extracts may be due to reduced concentrations of phenolic compounds, which are primary contributors to free radical neutralization.

3.3.2 ABTS Radical Cation Scavenging Activity

Results of the ABTS assay (Table 4) corroborated the DPPH findings, with ethyl acetate extracts showing the highest radical cation scavenging ability, followed by aqueous extracts. The ABTS assay is particularly sensitive to both hydrophilic and lipophilic antioxidants, and the strong performance of ethyl acetate extracts indicates the presence of a broad spectrum of antioxidant molecules.

Table 4. In vitro ABTS activity of M. deliciosa fruit (MD) at different solvents and concentrations compared with standard ascorbic acid

Concentration	Chloroform	Ethyl acetate	Ethanol	Methanol	Aqueous	Standard
20 µg/ ml	34.46 ± 0.106	64.66 ± 0.061	61.64 ± 0.222	63.76 ± 0.155	37.10 ± 0.035	34.892±0.018
30 µg/ ml	40.82 ± 0.201	79.88 ± 0.058	85.97 ± 0.133	80.95 ± 0.029	45.50 ± 0.029	43.317±0.015
40 µg/ ml	44.59 ± 0.050	92.09 ± 0.050	96.93 ± 0.029	99.05 ± 0.145	56.70 ± 0.050	65.889±0.515
IC 50 Value	49.8289	8.94519	12.1404	12.2877	33.6395	31.269

The observed ABTS scavenging activity suggests that M. deliciosa fruit extracts possess the capacity to neutralize reactive oxygen species in both aqueous and lipid environments, enhancing their therapeutic relevance in biological systems.

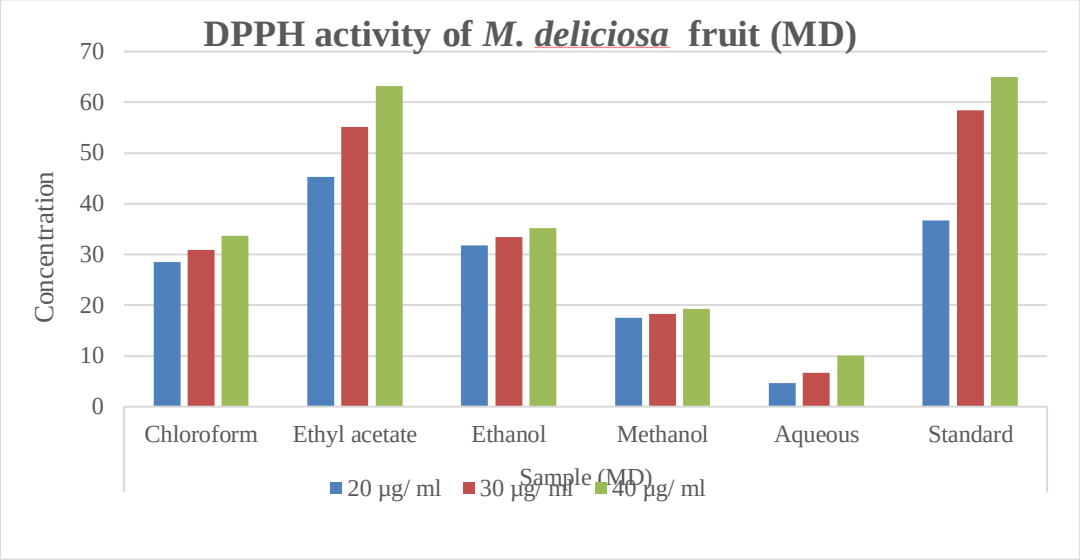
3.3.3 Ferric Reducing Antioxidant Power (FRAP)

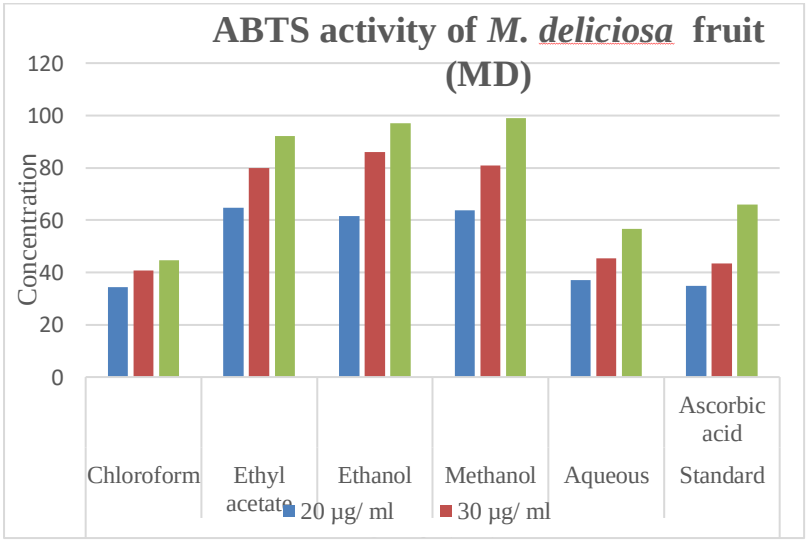
In contrast to DPPH and ABTS results, the aqueous extract demonstrated the highest ferric reducing antioxidant power (Table 5; Fig. 1). This indicates a stronger electron-donating ability, which is a key mechanism in preventing oxidative chain reactions. The elevated FRAP activity of the aqueous extract may be attributed to its high alkaloid, phenolic, and saponin content, which collectively enhance reducing potential [14,15].

The differential antioxidant behavior observed across assays highlights the importance of employing multiple methods to comprehensively evaluate antioxidant capacity, as each assay reflects a distinct mechanism of action.

Table 5. In vitro FRAP activity of M. deliciosa fruit (MD) at different solvents and concentrations compared with standard ascorbic acid

Concentration	MD					
	Chloroform	Ethyl acetate	Ethanol	Methanol	Aqueous	Standard
20 µg/ ml	3.65 ± 0.029	44.33 ± 0.012	9.99 ± 0.074	17.38 ± 0.025	54.71 ± 0.009	7.76 ± 0.312
30 µg/ ml	8.14 ± 0.010	52.18 ± 0.019	14.92 ± 0.014	26.89 ± 0.007	62.76 ± 0.042	15.52 ± 0.059
40 µg/ ml	13.51 ± 0.018	58.89 ± 0.009	19.61 ± 0.015	32.47 ± 0.007	71.43 ± 0.012	44.28 ± 0.120
IC 50 Value	114.314	27.5275	103.098	62.3658	14.4896	350.457





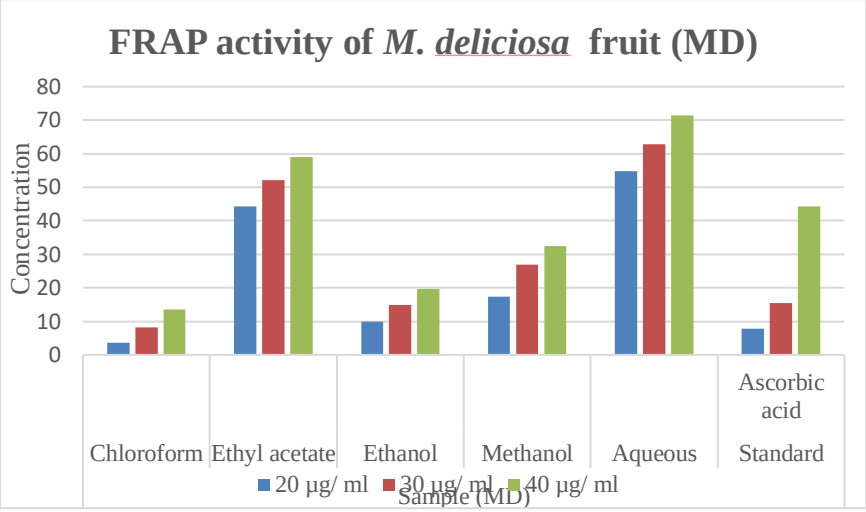


Fig 1: In vitro Antioxidant Activity of M. deliciosa fruit (MD)

3.4 UV-Visible Spectral Analysis

UV-Visible spectrophotometric analysis of M. deliciosa fruit extracts revealed multiple absorption peaks in the range of 319–434 nm, indicative of π–π* and n–π* electronic transitions associated with flavonoids, phenols, and other conjugated phytochemicals. Peaks observed between 330-360 nm are characteristic of flavonoid compounds, while absorption above 400 nm suggests the presence of complex polyphenolic structures Shows in Table.6&fig.3.

Table.6 Shows the absorbance of compounds.

Solvent	Wavelength (nm)	Absorbance
Chloroform	363	2.5389
Ethyl acetate	325	2.3281
Ethanol	320	2.2435
Methanol	355	2.3486
Aqueous	472	2.4572

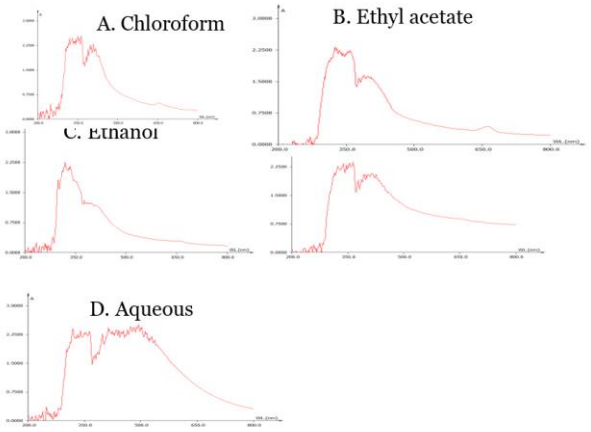


Fig.2 shows the UV-absorbance of different compounds.

These spectral features further confirm the abundance of antioxidant-related phytochemicals in the fruit extracts and support the quantitative phytochemical findings.

3.5 Antimicrobial Activity

The antimicrobial activity of M. deliciosa fruit extracts, evaluated using the disc diffusion method, revealed variable zones of inhibition against tested bacterial and fungal strains. Ethyl acetate and aqueous extracts exhibited noticeable antibacterial activity against Escherichia coli, Staphylococcus aureus, and Streptococcus mutans, while moderate antifungal activity was observed against Aspergillus species Shown in table.7 & fig.3.

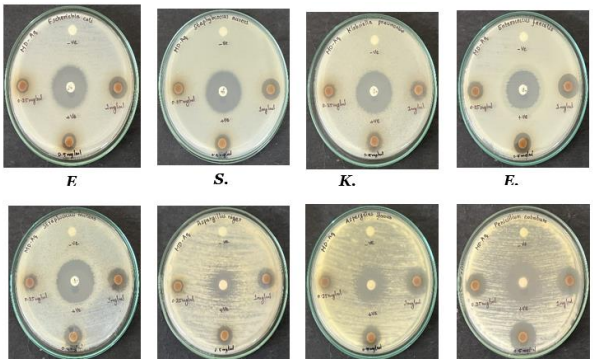


Fig.3 Antibacterial activity of M. deliciosa fruit aqueous extract against microbial strains by disc diffusion method

Table .7 Zone of inhibition of M. deliciosa fruit aqueous extract against microbial strains by disc diffusion method

Bacteria	0.25 mg/ml	0.5 mg/ml	1 mg/ml	+ve control	-ve control
Escherichia coli	9 mm	10 mm	14 mm	26 mm	NZ
Staphylococcus aureus	8 mm	11 mm	13 mm	26 mm	NZ
Klebsiella pneumoniae	8 mm	11 mm	12 mm	27 mm	NZ
Enterococcus faecalis	12 mm	13 mm	15 mm	25 mm	NZ
Streptococcus mutans	10 mm	13 mm	15 mm	29 mm	NZ
Fungi					
Aspergillus niger	8 mm	12 mm	14 mm	15 mm	NZ
Aspergillus flavus	9 mm	13 mm	17 mm	20 mm	NZ
Penicillium notatum	14 mm	18 mm	19 mm	23 mm	NZ

The antimicrobial efficacy of these extracts may be attributed to the synergistic action of alkaloids, flavonoids, phenols, and saponins, which are known to disrupt microbial cell membranes, inhibit enzyme activity, and interfere with nucleic acid synthesis. The absence of activity in certain extracts against specific strains suggests selective antimicrobial action, emphasizing the need for compound isolation and mechanistic studies.

CONCLUSION

The present study demonstrates that Monstera deliciosa fruit is a rich source of biologically active phytochemicals with promising therapeutic potential. Soxhlet extraction using solvents of varying polarity successfully yielded chloroform, ethyl acetate, ethanol, methanol, and aqueous extracts containing diverse classes of secondary metabolites. Qualitative phytochemical screening confirmed the widespread presence of glycosides, terpenoids, steroids, and carbohydrates across all extracts, while alkaloids and saponins were predominantly concentrated in the aqueous extract, and flavonoids and phenolic compounds were notably abundant in ethyl acetate and aqueous fractions. Quantitative analysis further substantiated these findings, revealing high levels of flavonoids, phenols, alkaloids, and saponins, which are well known for their antioxidant and pharmacological properties. In vitro antioxidant evaluation using DPPH, ABTS, and FRAP assays indicated that the ethyl acetate extract exhibited superior free radical scavenging activity, whereas the aqueous extract showed enhanced ferric reducing power, highlighting solvent-dependent variation in antioxidant efficacy. These results collectively suggest that M. deliciosa fruit possesses significant

antioxidant potential attributable to its rich phytochemical composition. Overall, the findings support the underexplored medicinal value of Monstera deliciosa fruit and provide a strong scientific basis for its further investigation as a natural source of antioxidant, antimicrobial, and anticancer agents. Future studies focusing on detailed compound characterization and biological validation will be crucial to translate these preliminary findings into therapeutic applications.

REFERENCES

1. Prosanta, D., et al. (2015). Antioxidant, antibacterial and anticancer activity of Monstera deliciosa. Journal of Pharmacognosy and Phytochemistry, 4(2), 45–52.
2. Kumar, R., Singh, P., & Verma, S. (2018). Evaluation of antimicrobial activity of Monstera deliciosa extracts. International Journal of Pharmaceutical Sciences and Research, 9(6), 2456–2462.
3. Blois, M. S. (1958). Antioxidant determinations by the use of a stable free radical. Nature, 181(4617), 1199–1200. https://doi.org/10.1038/1811199a0
4. Rao, M. S., Kumar, A., & Reddy, P. (2015). Phytochemical screening and antioxidant activity of Monstera deliciosa. Asian Journal of Pharmaceutical and Clinical Research, 8(3), 123–127.
5. Brand-Williams, W., Cuvelier, M. E., & Berset, C. (1995). Use of a free radical method to evaluate antioxidant activity. LWT – Food Science and Technology, 28(1), 25–30. https://doi.org/10.1016/S0023-6438(95)80008-5
6. Harborne, J. B. (1998). Phytochemical methods: A guide to modern techniques of plant analysis (3rd ed.). Chapman & Hall.
7. Shirsul, P. B., Patil, S. R., & Kulkarni, A. P. (2024). Green synthesis of gold nanoparticles using Monstera deliciosa leaf extract and evaluation of their biomedical applications. Materials Today: Proceedings, 72, 198–204. https://doi.org/10.1016/j.matpr.2023.09.115
8. Re, R., Pellegrini, N., Proteggente, A., Pannala, A., Yang, M., & Rice-Evans, C. (1999). Antioxidant activity applying an improved ABTS radical cation decolorization assay. Free Radical Biology and Medicine, 26(9–10), 1231–1237. https://doi.org/10.1016/S0891-5849(98)00315-3
9. Kumar, R., Singh, P., & Verma, S. (2018). Evaluation of antimicrobial and antioxidant activity of Monstera deliciosa extracts. International Journal of Pharmaceutical Sciences and Research, 9(6), 2456–2462.
10. Oyaizu, M. (1986). Studies on products of browning reactions: Antioxidative activities of products of browning reaction prepared from glucosamine. Japanese Journal of Nutrition, 44(6), 307–315. https://doi.org/10.5264/eiyogakuzashi.44.307
11. Sindhu, R., Nair, R., & Menon, S. (2023). Phytochemical profiling and biological activities of underutilized medicinal plants. Journal of Herbal Medicine, 38, 100612. https://doi.org/10.1016/j.hermed.2023.100612
12. Pandey, A., Tripathi, S., & Pandey, R. (2014). Alternative therapies useful in the management of diabetes: A systematic review. Journal of Pharmacy Research, 8(11), 1624–1629.
13. Rao, M. S., Kumar, A., & Reddy, P. (2015). Phytochemical screening and antioxidant potential of Monstera deliciosa. Asian Journal of Pharmaceutical and Clinical Research, 8(3), 123–127.
14. Prosanta, D., Ghosh, A., & Banerjee, S. (2015). Antioxidant, antibacterial and anticancer activity of Monstera deliciosa. Journal of Pharmacognosy and Phytochemistry, 4(2), 45–52.
15. Singleton, V. L., Orthofer, R., & Lamuela-Raventós, R. M. (1999). Analysis of total phenols and other oxidation substrates by means of Folin–Ciocalteu reagent. Methods in Enzymology, 299, 152–178. https://doi.org/10.1016/S0076-6879(99)99017-1

