

Abstract

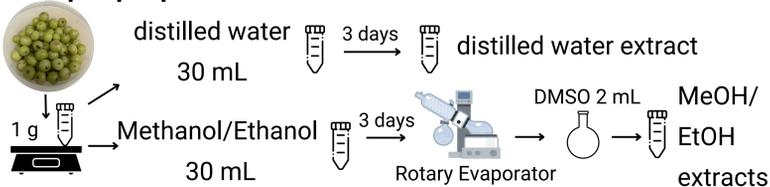
Indian gooseberry (*Phyllanthus emblica*) is rich in antioxidants that help to reduce cellular damage and disease risks. This study aims to compare the efficiency of antioxidant extraction from Indian gooseberry using 3 different solvents: distilled water, methanol, and ethanol. One gram of Indian gooseberry pulp was soaked in 30 mL of each solvent and incubated at room temperature for 3 days. The extracts were then filtered and analyzed for total phenolic content (TPC), total flavonoid content (TFC), and antioxidant capacity using DPPH, ABTS, and FRAP assays. The experimental results indicated that different solvents affected the amount of extracted compounds. Methanol yielded the highest TPC (35.91±1.19 mg GAE/g), while distilled water gave the highest TFC (136.85±2.21 mg QE/g). For antioxidant activity, DPPH results were similar for methanol and distilled water, but ABTS showed higher activity for methanol. Distilled water showed the highest FRAP activity (163.76±1.98 mg AAE/g). Ethanol extract had the lowest antioxidant efficiency. Due to safety concerns with methanol, distilled water is recommended for food, pharmaceutical, and cosmetic applications.

Objective

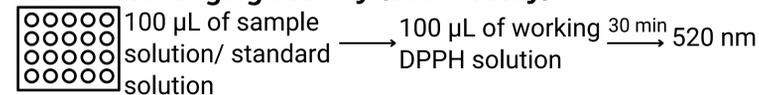
To compare the antioxidant extraction efficiency from Indian gooseberry using three solvents: distilled water, methanol, and ethanol.

Methodology

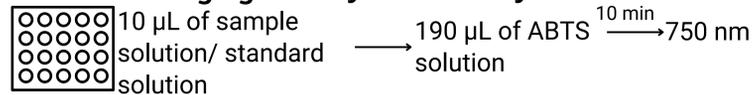
Sample preparation



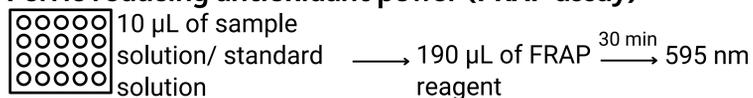
Radical scavenging activity (DPPH assay)



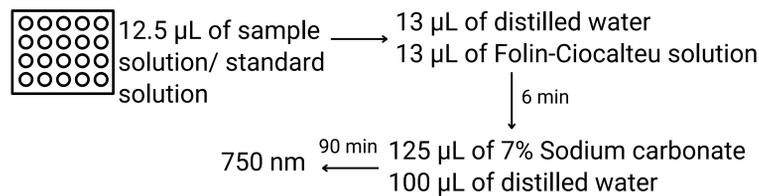
Radical scavenging activity (ABTS assay)



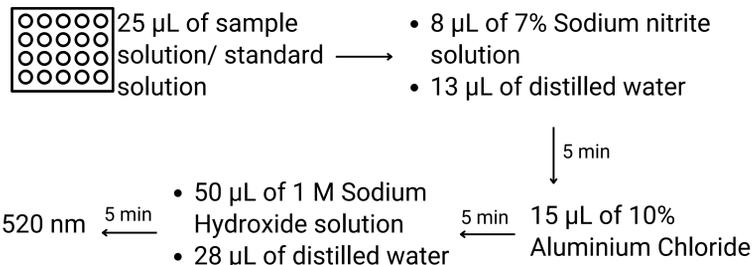
Ferric reducing antioxidant power (FRAP assay)



Total Phenolic Content



Total Flavonoid Content



Results and Discussion

1. Extraction yield

Table 1: Yields of Indian gooseberry extracts using different solvents

Sample	Solvent	% Yield crude sample
Sample 1	Methanol	11.24±0.50
	Ethanol	7.58±0.12
Sample 2	Methanol	18.90±1.11
	Ethanol	10.96±0.08

Each value is expressed as the mean ± SD (n = 3).

*Sample 1: Indian gooseberry from Saraburi, Sample 2: Indian gooseberry from Chiang Rai

- The yield of Indian gooseberry extracts using methanol is noticeably higher than that obtained using ethanol.
- The yield of distilled water extract could not be determined because, after soaking Indian gooseberry pulp in distilled water, the solvent was not evaporated, making it impossible to calculate the yield.

2. Determination of total phenolic compounds and total flavonoids

Table 2: Total phenolic and flavonoid contents in Indian gooseberry crude extracts

Sample	Solvent	Total Phenolic Content (mg GAE/g, crude extract)	Total Flavonoid Content (mg QE/g, crude extract)
Sample 1	Distilled water	30.90±4.53	60.76±2.01
	Methanol	21.70±4.03	38.67±7.13
	Ethanol	14.21±1.62	31.05±5.63
Sample 2	Distilled water	20.12±0.38	136.85±2.21
	Methanol	35.91±1.19	47.01±6.26
	Ethanol	22.12±1.33	27.11±2.20

Each value is expressed as the mean ± SD (n = 3).

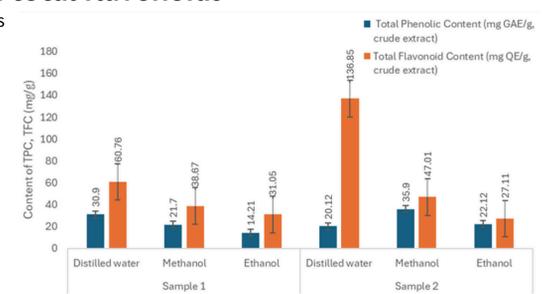


Fig 1: Total phenolic content and total flavonoid content of Indian gooseberry extracts from different solvents

Total Phenolic Content:

- Methanol extract from sample 2 provided the highest phenolic content at 35.91±1.19 mg GAE/g crude extract.

Total Flavonoid Content:

- Distilled water extract from sample 2 provided the highest flavonoid content at 136.85±2.21 mg QE/g crude extract.

3. Antioxidant activity test

Table 3: Antioxidant capacity of Indian gooseberry crude extracts

Sample	Solvent	IC ₅₀ (µg/mL)		FRAP (mgAAE/g, crude extract)
		DPPH	ABTS	
Sample 1	Distilled water	0.02±0.79	0.46±1.04	39.27±1.39
	Methanol	0.02±0.70	0.09±2.23	32.67±4.82
	Ethanol	0.03±2.65	0.08±0.78	27.22±2.92
Sample 2	Distilled water	0.01±1.44	0.02±0.78	163.76±1.98
	Methanol	0.02±0.55	0.03±1.00	97.77±8.37
	Ethanol	0.02±0.76	0.05±0.55	57.10±2.31

Each value is expressed as the mean ± SD (n = 3).

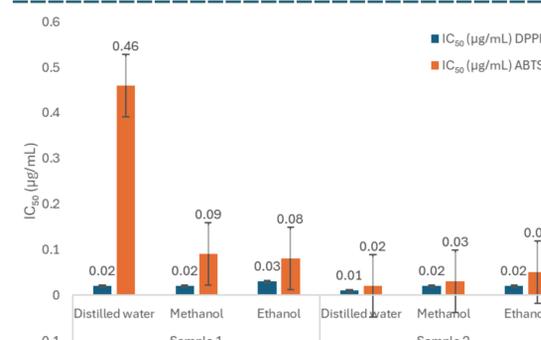


Fig 2: DPPH and ABTS of Indian gooseberry crude extracts from different solvents

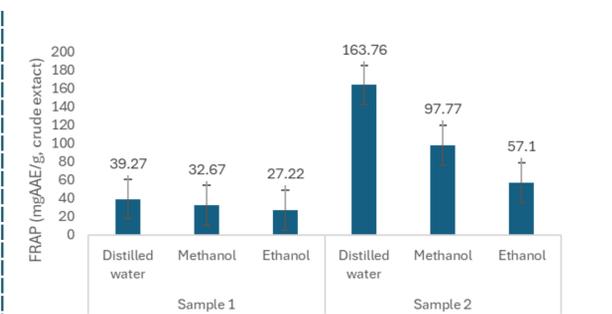


Fig 3: FRAP of Indian gooseberry crude extracts from different solvents

DPPH assay:

- The extracts obtained from distilled water and methanol from both samples had comparable antioxidant capacities.

ABTS assay:

- The methanol-extracted compounds from both samples exhibited higher antioxidant efficiency than those extracted with distilled water.

FRAP assay:

- Distilled water extract from sample 2 showed the highest antioxidant activity at 163.76±1.98 mg AAE/g crude extract.

References

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Conclusions

- The experimental results indicate that different solvents affect the amount of extracted compounds.
- Distilled water and methanol extracts show similar results**, but methanol has safety limitations.
- Distilled water is the most suitable solvent** due to its high efficiency and safety for industrial applications.
- This study provides a guideline to select appropriate solvents for antioxidant extraction for commercial use.
- The source of Indian gooseberry impacts its chemical composition and antioxidant activity, influenced by environmental factors such as climate, soil conditions, and cultivation methods.

Acknowledgements

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