Phytochemical and antioxidant Study of Ficus carica species available in Faisalabad region

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ABSTRACT

Background: The fig tree's fruits, once crucial for sustenance, are now prized as a gastronomic delicacy in sub-tropical and tropical regions, with limited production in temperate zones. Cultivated globally, fig trees show significant domestication, leading to enhanced fruit characteristics and vegetative propagation. In the wild, fig trees rely on bird-dispersed seeds, growing in diverse environments, including urban areas and Mediterranean landscapes. Spontaneous fig populations are valuable for scientific research and breeding, with recent studies uncovering their nutritional and medicinal benefits, such as laxative effects and potential cancer cell inhibition from fig latex. While some pharmacological qualities of fig components have been explored, research in these areas remains limited.

Methods: A comprehensive evaluation of the antioxidant potential of botanical extracts involves a multifaceted approach, incorporating various techniques to assess different aspects of antioxidant activity. This evaluation typically begins with initial phytochemical analysis to identify and quantify bioactive compounds present in the extract, particularly phenolic and flavonoid compounds, which are known for their antioxidant properties.

Results: The findings suggest that seeds are abundant in antioxidants, indicating their promise as sources of phenolic compounds, withpotential for future antioxidant applications.

Conclusions: Based on the outcomes of this investigation, it can be inferred that the species demonstrates effectiveness in neutralizing free radicals and exhibits potent antioxidant property.

Keywords:Antibacterial activity, antioxidant activity, *ficuscarica*, flavonoid compound, phenolic compounds, solvent extraction.

Introduction:

The fig tree is widespread in the Mediterranean and Portugal, known for its fiber content and potential health benefits. Research shows fig latex can inhibit cancer cell formation. Limited research exists on other medicinal aspects of the fig tree. Traditional methods of phenolic extraction require a lot of solvents and time (Teixeira, Patão, Coelho, & da Costa, 2006). New analytical methods aim to be more efficient and eco-friendly, such as matrix solid-phase dispersion. This technique is used for simultaneous disruption and extraction of solid samples (Barker, 2000). The Ficus genus is part of the Moraceae family with over 800 species, mainly in tropical regions. The Asian-Australasian region has the highest Ficus species diversity. Ficus trees show genetic diversity and various properties contributing to their commercial and pharmacological value(Shi et al., 2018).

The "common fig," scientifically called Ficus carica, belongs to the Moraceae family and has leaves with therapeutic benefits for gastrointestinal disorders when used in tea or as a remedy (Chaudhary et al., 2012). Ficus carica leaves are effective for various health conditions like respiratory issues, cardiovascular ailments, and diabetes, based on historical sources highlighting their medicinal properties. The leaves of Ficus carica contain 126 chemical components and have antioxidant activity, showing potential health benefits (Alcântara et al., 2019). The addition of Ficus carica leaves offers benefits such as simplicity, convenience, pace of nanoparticle creation, health benefits, and capital investments. The plant leaves can create silver nanoparticles rapidly due to certain agents present in the extracts. Compounds like carboxyl, amine, or proteins play a key role in creating and stabilizing nanoparticles. Radiation, especially ultra-violet and visible radiation, affects reaction speeds significantly (Rónavári et al., 2021). Plants with antioxidant and anti-cancer qualities are of interest due to the rise in cancer incidence. Antioxidants can neutralize nonradical species and inhibit various free radical species, beneficial for illnesses like diabetes and cancer (Seifried, McDonald, Anderson, Greenwald, & Milner, 2003). The WHO reported that a large percentage of people worldwide depend on traditional therapies, particularly natural botanicals, for healthcare and illness treatment (Manzoor et al.).

Experimental Work:

Collection of Sample:

The Ficus carica, or common fig, thrives in climates like those in Multan, Dera Ismail Khan, Balochistan, and Pakhtunkhwa in Pakistan, thriving in sunny and dry conditions. Its fruits are cherished for their nutrition and sweetness, and leaves and fruits from Multan orchards were collected for use.

Plant materials extract:

After drying Ficus carica leaves and grinding them into a powder, 20g samples were extracted using various solvents: 100% methanol, 80% methanol (methanol to water ratio), 100% ethanol, and 80% ethanol (ethanol to water ratio) for 7.5 to 8.5 hours. The extracts were separated using Whatmann filter paper 1, concentrated at 45°C under reduced pressure, and stored at -3.9°C until testing.

Analyzing the antioxidant capacity of plant extraction

The subsequent experiments Such as total phenol and flavonoid content, DPPH radical analysis and reducing power extract were carried out to assess each variety of *Ficus carica's* antioxidant properties.

Statistical analysis:

Statistical analysis in each trial utilized mean percentages with standard deviations (SD) to show central tendency and dispersion. Correlation coefficients assessed relationships within groups, while ANOVA established significant differences ($p \leq 0.05$) among diverse groups, aiding nuanced data interpretation and group comparisons(Borenstein, Cooper, Hedges, & Valentine, 2009).

The significance level of $p \leq 0.05$ ensured robustness in detecting meaningful differences between groups, reflecting the study's statistical rigor. Employing mean percentages, standard deviations, correlation coefficients, and ANOVA contributed to a comprehensive statistical analysis, crucial for reliable conclusions in scientific research (Amrhein, Korner-Nievergelt, & Roth, 2017).

Results and Discussions:

Comprehensive Phenolic Levels:

The assessment of total phenolic content (TPC) is crucial for understanding the antioxidant properties of plant materials due to the strong antioxidant qualities of plant phenolics. Results of TPC evaluation on Ficus carica leaves show varying concentrations in different solvents, with highest in aqueous ethanol, emphasizing its effectiveness in extracting phenolic compounds. The variations in TPC concentrations among solvents were statistically significant, indicating solvent-dependent extraction efficiency and capacity to dissolve floral antioxidants.Ethanol emerged as the optimal solvent for extracting phenolic mixtures from Ficus carica leaves, attributed to its minimal toxicity and excellent extraction performance. This underscores the crucial role of solvent choice in enhancing extraction procedures (Shahidi, Varatharajan, Oh, & Peng, 2019).

Table 1.1: *Total phenolic content GAE (mg /100g of dry sample) in extract Ficus carica*

Entry	Extracts (%)	Total phenolic content
1	100(methanol)	11.68±0.03
2	70 (methanol)	12.36±0.02
3	100 (ethanol)	10.59±0.03
4	70(ethanol)	15.32±0.02
5	Decoction	10.42±0.03
6	Distilled water	9.14±0.03

Comprehensive flavonoids Levels:

The presence of flavonoids is pivotal for the antioxidant properties of fruits and vegetables, underscoring the need to quantify flavonoid levels in fresh plant matter. The extraction of flavonoids from Ficus carica leaves using various solvents exhibited notable differences, with decoction proving to be the most efficient method for extracting total flavonoid content. The choice of ethanol as a solvent for removing antioxidant compounds from plants is crucial due to its high extraction efficiency and low toxicity, emphasizing the importance of solvent selection for maximizing flavonoid extraction from Ficus carica leaves while considering safety and effectiveness (Calado et al., 2015).

Table 1.2: *Entire flavonoid attention CE (mg/100g of dry weight) GAE (mg/100g of dry sample) in extracts of Ficus carica*

Entry	Extracts (%)	Total flavonoids
1	100(methanol)	11.67±0.03
2	70(methanol)	14.47±0.02
3	100 (ethanol)	12.97±0.02
4	70(ethanol)	15.87±0.01
5	Decoction	10.55±0.01
6	Distilled water	8.40±0.02

The data shows the average standard deviation from three separate experiments. Significant differences ($p \leq 0.05$) in the average of the various extracting solvents are indicated by different superscript letters within the same column.

Examining DPPH Radical Reduction:

DPPH, an organic free radical, appears violet between 515-528 nm due to absorption peaks, with increased hydroxylation enhancing its elimination by leaf extracts as antioxidants(Ayoub, Hassan, Hamid, Abdelhamid, & Souad, 2019). Ficus carica's most potent radical scavenging activity is in ethanol-based leaf extracts, with phenolic components potentially contributing to DPPH radical scavenging(Mahmoudi, Khali, Benkhaled, Benamirouche, & Baiti, 2016).

Table 1.3: *Assay for scavenging DPPH radicals*

Entry	Extracts (%)	IC_{50} values
1	100(methanol)	0.092±0.75
2	70(methanol)	0.084±0.37
3	100 (ethanol)	0.087±0.24
4	70(ethanol)	0.073±0.53
5	Decoction	0.209±0.28
6	Distilled water	0.319±0.21

The data presented represent the mean and standard deviation derived from three distinct experiments. Significance differences among the average extracting solvent values are denoted by diversesuperior letters within the similar column, with a significance level of $p \leq 0.05$.

The presented data represents the unkind ± SD from trio distinct experiments, and dissimilarsuperior letters inside the identical column indicate a significant ($p \leq 0.05$) difference in means among the extracting solvents.

Extracts from Ficus carica leaves showed varying DPPH radical scavenging abilities, with IC_{50} values ranging from 0.072 to 0.209 mg/ml of dry matter, highlighting the impact of extraction solvent on antioxidant activity.

Radical Scavenging Extract:

Extracts' reducing potential can be measured, altering color from yellow to blue-green, with a direct correlation between antioxidant activity and reducing power shown by bioactive compounds. Extracts consistently displayed increased reducing power with concentration, with absorbance values falling within a specific range for various extracts, similar to linoleic acid inhibition(Meziant et al., 2021).

Table 1.4: *Reducing power of Ficus caricaleaves extract*

Entry	Extract (%)	Concentration (mg/ml)	Reducing power of *Ficus carica*
1	100 (methanol)	20	0.353±0.02
		30	0.400±0.02
		40	0.418±0.02
2	70 (methanol)	50	0.492±0.01
		10	0.518±0.01
		30	0.548±0.02
3	100 (ethanol)	40	0.568±0.02
		50	0.598±0.01
		20	0.600±0.01
4	70 (ethanol)	10	0.608±0.02
		20	0.522±0.02
		30	0.650±0.01
5	Decoction	40	0.760±0.02
		50	0.770±0.02
		10	0.556±0.01

6	Distilled water	10	0.567±0.02
		20	0.511±0.01

The data represent the mean ± SD from three differenttests, and diversesuperior letters within the same column indicate significant differences ($p < 0.05$) in the averages of the diverseremoving solvents.

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