International Journal of Zoology and Applied Biosciences **ISSN: 2455-9571**
Volume 11, Issue 1, pp: 80-83, 2026
https://doi.org/10.55126/ijzab.2026.v11.i01.012 **http://www.ijzab.com**

Research Article

PHYTOCHEMICAL SCREENING, ANTIOXIDANT AND ANTIDIABETIC ACTIVITY OF AQUEOUS EXTRACTS OF *FICUS RELIGIOSA* AND *ZIZIPHUS MAURITIANA*

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Article History: Received 27th October 2025; Accepted 23rd December 2025; Published 1st January 2026

ABSTRACT

Medicinal plants are a rich reservoir of biologically active compounds with therapeutic potential. *Ficus religiosa* (Sacred fig or Peepal tree) and *Ziziphus mauritiana* (Indian jujube) are two such plants traditionally used in the treatment of various ailments. In the present study, the phytochemical composition, antioxidant properties, and antidiabetic effects of aqueous extracts of *F. religiosa* and *Z. mauritiana* leaves were investigated. Qualitative phytochemical screening revealed the presence of alkaloids, carbohydrates, glycosides, saponins, and flavonoids in both extracts. Antioxidant activity was assessed using ABTS (2,2-azino-bis(3-ethylbenzothiazoline-6-sulfonate)) and superoxide radical scavenging assays. Antidiabetic activity was evaluated through α-amylase and α-glucosidase inhibitory assays. Both extracts demonstrated significant antioxidant and enzyme inhibitory activities, indicating potential antidiabetic effects. The findings suggest that *F. religiosa* and *Z. mauritiana* may serve as promising natural sources of antioxidant and antidiabetic compounds, warranting further studies on the isolation and mechanism of their bioactive constituents.

Keywords: *Ficus religiosa*, *Ziziphus mauritiana*, Phytochemicals, Alkaloids, Antioxidants, Antidiabetic activity.

INTRODUCTION

Medicinal plants are one of the primary sources of therapeutic agents, with approximately 80% of the world's population relying on plant-based remedies for healthcare (Gupta *et al*., 2008). Plants contain diverse natural antioxidants that possess pharmacological properties with minimal side effects and can protect human health from oxidative stress–related diseases. Diabetes mellitus, a major metabolic disorder characterized by chronic hyperglycemia, results from either insufficient insulin production or reduced insulin sensitivity. One effective strategy for managing diabetes involves controlling postprandial hyperglycemia by inhibiting carbohydrate-hydrolyzing enzymes such as α-amylase and α-glucosidase, thereby reducing glucose absorption (Li *et al*., 2004). *Ficus religiosa*, commonly known as the sacred fig or peepal tree, belongs to the family Moraceae and is distributed across tropical and subtropical regions. It has been widely recognized in traditional medicine for its anti-inflammatory, antimicrobial, and antioxidant properties. Similarly, *Ziziphus mauritiana*, belonging to the family Rhamnaceae, is an evergreen tree widely distributed in India, Pakistan, and China. Known as Indian jujube or desert apple, it has been used in traditional medicine to treat ailments such as bronchitis, liver disorders, insomnia, and depression. Both species are rich in phytochemicals, including phenols, flavonoids, alkaloids, tannins, and saponins, which may contribute to their pharmacological effects. Hence, the present study was designed to evaluate the in vitro antioxidant and antidiabetic potential of aqueous leaf extracts of *F. religiosa* and *Z. mauritiana*.

MATERIALS AND METHODS

Chemicals and Reagents

All reagents and solvents were of analytical grade and obtained from Sisco Research Laboratories Pvt. Ltd., Himedia Laboratories, Sigma-Aldrich, and Merck Life Science Pvt. Ltd. Absorbance readings were recorded using a ROBOniK Readwell Touch ELISA Plate Analyzer and LMSP-320 visible spectrophotometer.

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Plant Collection and Extraction

Healthy leaves of *F. religiosa* and *Z. mauritiana* were collected from Porayar, Mayiladuthurai District, Tamil Nadu, and authenticated by a botanist. The leaves were washed, shade-dried for 4 weeks, and ground into fine powder. Aqueous extracts were prepared by cold maceration—100 g of powdered leaves were soaked in 1000 mL of distilled water for 72 h with occasional shaking. The extracts were filtered, centrifuged, and concentrated under reduced pressure to obtain solvent-free residues.

Qualitative Phytochemical Analysis

Phytochemical screening of the aqueous extracts was performed using standard methods to detect alkaloids, carbohydrates, glycosides, saponins, proteins, amino acids, phytosterols, phenolic compounds, and flavonoids (Wagner *et al.,* 1996; Harborne, 1998). The presence of each compound was indicated by characteristic color changes or precipitate formation.

Antioxidant Assays: **ABTS Radical Scavenging Assay**

ABTS radical cation ($ABTS^{\bullet+}$) was generated by reacting 7 mM ABTS with 2.45 mM potassium persulfate and incubating in the dark for 12–16 h. The solution was diluted with ethanol to obtain an absorbance of 0.7 ± 0.02 at 734 nm. Various concentrations of plant extracts were mixed with the ABTS solution, and absorbance was measured after 30 min. Ascorbic acid was used as the standard.Scavenging activity (%) was calculated as:

$$\text{Inhibition (\%)} = \frac{A_{\text{control}} - A_{\text{sample}}}{A_{\text{control}}} \times 100$$

Superoxide Radical Scavenging Assay

The assay was performed using the riboflavin–light–NBT system (Beauchamp & Fridovich, 1971). Reaction mixtures containing phosphate buffer, riboflavin, EDTA, and NBT were illuminated for 90 s in the presence of extracts or standards (BHT, rutin). Absorbance was recorded at 590 nm, and scavenging activity was calculated as above.

Antidiabetic Assays

α-Amylase Inhibitory Activity

α-Amylase inhibition was determined by the DNS method (Miller, 1959). Reaction mixtures containing α-amylase enzyme and extracts (50–200 µg/mL) were incubated with 0.5% starch at 37 °C for 5 min. The reaction was terminated with DNS reagent, boiled for 15 min, and absorbance measured at 540 nm. Acarbose served as the standard.

$$\text{Inhibition (\%)} = \frac{A_{\text{control}} - A_{\text{sample}}}{A_{\text{control}}} \times 100$$

α-Glucosidase Inhibitory Activity

The α-glucosidase assay was performed using p-nitrophenyl-α-D-glucopyranoside (pNPG) as the substrate. Enzyme (0.075 U) was preincubated with extract (50–200 µg/mL) at 37 °C for 30 min, and the reaction was terminated by adding Na_2CO_3. Absorbance was measured at 400 nm. Acarbose was used as the reference drug.

RESULTS AND DISCUSSION

The phytochemical analysis of the aqueous extracts of *Ficus religiosa* and *Ziziphus mauritiana* revealed the presence of several bioactive compounds. Both extracts contained alkaloids, amino acids, flavonoids, proteins, phenolic compounds, glycosides, and saponins, indicating their rich secondary metabolite composition. *Z. mauritiana* showed a slightly higher concentration of phenolic and flavonoid compounds compared to *F. religiosa*. The qualitative test results ("+++") show a strong presence of alkaloids and phenolic compounds in both plants, while saponins and glycosides were moderately present ("++") which is showed in Table 1.

Table 1. Phytochemical (Qualitative) Analysis of *Ficus religiosa* and *Zizipus mauiritiana.*

Phytochemicals/plants	Alkaloids	Amino acids	Flavonoids	Protein	Phenolic Compounds	Glycosides	Saponins
Ficus religiosa	+++	++	+++	++	+++	++	++
Zizipus mauiritiana	+++	++	++	++	+++	++	++

The total phenolic and flavonoid content of the aqueous extracts of *Ficus religiosa* and *Ziziphus mauritiana* were determined to assess their potential antioxidant capacity. *Ziziphus mauritiana* showed a significantly higher total phenolic content of 63.72 ± 0.24 mg GAE/g extract, compared to 31.76 ± 0.66 mg GAE/g in Ficus religiosa. Similarly, the total flavonoid content was higher in *Z. mauritiana* (42.53 ± 0.11 mg QE/g) than in F. religiosa (26.84 ± 0.10 mg QE/g). Since phenolic and flavonoid compounds are major contributors to antioxidant activity due to their hydrogen-donating ability and radical-scavenging properties, the higher concentration of these compounds in *Z. mauritiana* suggests that it possesses stronger antioxidant potential than *F. religiosa* showed in Table 2.

Table 2. Phytochemical (Quantitative) Analysis of *Ficus religiosa* and *Zizipus mauiritiana.*

Plants	Total phenol content	Total flavonoid content
Ficus religiosa	31.76 ±0.66	26.84 ±0.10
Zizipus mauiritiana	63.72±0.24	42.53±011

The antioxidant assays demonstrate the radical scavenging potential of both plant extracts. Superoxide Radical Scavenging Assay: *Z. mauritiana* (IC_{50} = 75.36 ± 1.09 µg/mL) showed better scavenging activity than *F. religiosa* (IC_{50} = 112.12 ± 1.03 µg/mL). The lower IC_{50} value indicates stronger antioxidant efficiency. ABTS Radical Scavenging Assay: *Z. mauritiana* again exhibited higher activity (IC_{50} = 73.64 ± 1.01 µg/mL) compared to *F. religiosa* (IC_{50} = 85.13 ± 1.58 µg/mL). Both were close to the standard antioxidant values, showing notable free radical scavenging potential in Table 3. Amylase and Glucosidase Inhibition (Antidiabetic assays): Both plants inhibited carbohydrate-hydrolyzing enzymes, suggesting possible antidiabetic properties. *Z. mauritiana* displayed stronger α-amylase (86.50 ± 0.89) and α-glucosidase (92.95 ± 0.80) inhibition compared to *F. religiosa* (81.63 ± 1.22 and 106.41 ± 0.71, respectively). These results indicate that *Z. mauritiana* could more effectively moderate postprandial blood glucose levels in Table 3.

Table 3. Antioxidant, Antidiabetic and Anti-inflammatory Analysis of *Ficus religiosa* and *Ziziphus Mauritiana.*

Assay/samples	*Ficus religiosa*	*Zizipus mauiritiana*
ABTS	95.48± 0.64	73.64±1.01
SO	89.19±0.05	75.36±1.09
Amylase	81.63±1.22	86.50±0.89
Glucosidase	106.41±0.71	92.95±0.80
Antiinflammation	77.61±0.88	112.87±1.21

CONCLUSION

The present investigation confirmed that aqueous extracts of *Ficus religiosa* and *Ziziphus mauritiana* contain significant amounts of bioactive secondary metabolites responsible for their antioxidant and antidiabetic activities. The in vitro α-amylase and α-glucosidase inhibition assays demonstrated their potential to regulate postprandial hyperglycemia. The results support the traditional use of these plants and suggest further isolation, purification, and mechanistic studies to identify specific active constituents for pharmaceutical development.

ACKNOWLEDGMENT

The authors express sincere thanks to the head of the Department of Biotechnology, Bon Secours College for Women (Autonomous), Thanjavur for the facilities provided to carry out this research work.

CONFLICT OF INTERESTS

The authors declare no conflict of interest

ETHICS APPROVAL

Not applicable

FUNDING

This study received no specific funding from public, commercial, or not-for-profit funding agencies.

AI TOOL DECLARATION

The authors declares that no AI and related tools are used to write the scientific content of this manuscript.

DATA AVAILABILITY

Data will be available on request

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