World Journal of Pharmaceutical Science and Research
www.wjpsronline.com
Research Article
ISSN: 2583-6579
SJIF Impact Factor: 5.111
Year - 2025
Volume: 4; Issue: 2
Page: 485-490

INVITRO SCREENING OF CARICA PAPAYA FOR ANTIDIABETIC ACTIVITY

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Article Received: 19 February 2025 | | ***Article Revised: 08 March 2025*** | | ***Article Accepted: 31 March 2025***

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DOI: https://doi.org/10.5281/zenodo.15159115

How to cite this Article: Dr. Malepati Sandhya Rani, S. Aarifa, T. Mounika, T. Akshaya, V. Sravani, Y. Tasmeen Anjum (2025). INVITRO SCREENING OF CARICA PAPAYA FOR ANTIDIABETIC ACTIVITY. World Journal of Pharmaceutical Science and Research, 4(2), 485-490. https://doi.org/10.5281/zenodo.15159115

ABSTRACT

Background: Diabetes mellitus (DM) is a chronic metabolic disorder characterized by hyperglycemia. Herbal medicines like Carica papaya are being explored for their antidiabetic potential. **Objective:** This study evaluates the antidiabetic activity of Carica papaya leaf extract through phytochemical screening and enzyme inhibition assays. **Methods:** Ethanolic extracts of Carica papaya leaves were obtained via Soxhlet extraction. Phytochemical screening identified bioactive compounds. The α-amylase inhibitory potential was analyzed using spectrophotometry at 540 nm. **Results:** The extract contained flavonoids, terpenoids, and phenolics, which exhibited α-amylase inhibition in a dose-dependent manner. The inhibition was 21.30% at 10 µg/mL and 69.44% at 60 µg/mL, showing a promising trend comparable to the standard drug, acarbose. **Conclusion:** The study suggests that Carica papaya leaf extract has potential antidiabetic activity. Further in vivo and clinical studies are required to validate its therapeutic efficacy.

KEYWORDS: Carica papaya, α-amylase inhibition, antidiabetic activity, phytochemicals, glucose uptake.

INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by prolonged hyperglycemia, resulting from either insufficient insulin secretion or insulin resistance. It is a global health concern affecting millions of individuals worldwide, with an alarming increase in prevalence due to lifestyle changes, urbanization, and genetic predisposition.[1] The World Health Organization (WHO) has projected that diabetes will be among the leading causes of morbidity and mortality by 2030, making it a significant public health challenge.[2]

Diabetes is categorized into two primary types: Type 1 diabetes (T1DM), which results from autoimmune destruction of pancreatic beta cells leading to absolute insulin deficiency, and Type 2 diabetes (T2DM), which is associated with insulin resistance and relative insulin deficiency.[3] T2DM accounts for nearly 90% of all diabetes cases and is primarily influenced by obesity, physical inactivity, and poor dietary habits.[4] Uncontrolled diabetes can lead to severe complications, including cardiovascular diseases, neuropathy, nephropathy, retinopathy, and an increased risk of infections, significantly impacting the quality of life and increasing healthcare costs.[5]

Current pharmacological interventions for diabetes include insulin therapy, biguanides, sulfonylureas, thiazolidinediones, dipeptidyl peptidase-4 (DPP-4) inhibitors, and sodium-glucose co-transporter-2 (SGLT2) inhibitors.[6] However, these drugs are often associated with side effects such as hypoglycemia, weight gain, and gastrointestinal disturbances, necessitating the search for alternative therapies.[7]

Medicinal plants have been extensively studied for their potential in managing diabetes due to their natural bioactive compounds, which exhibit hypoglycemic and antioxidant properties. Carica papaya, commonly known as papaya, is a tropical plant with various pharmacological activities, including antidiabetic effects.[8] Different parts of the plant, such as leaves, seeds, and fruits, contain active compounds such as flavonoids, alkaloids, tannins, and saponins, which are known to influence glucose metabolism by inhibiting carbohydrate-digesting enzymes, enhancing insulin sensitivity, and reducing oxidative stress.[9]

The α-amylase enzyme plays a crucial role in carbohydrate digestion by breaking down starch into simpler sugars, leading to postprandial hyperglycemia. Inhibiting α-amylase activity is a well-established therapeutic strategy for controlling blood glucose levels in diabetes.[10] Natural α-amylase inhibitors from plants offer a promising alternative to synthetic drugs such as acarbose, which is commonly used for managing diabetes but is associated with gastrointestinal side effects.[11]

This study aims to evaluate the in vitro antidiabetic activity of Carica papaya leaf extract through α-amylase inhibition and glucose uptake assays.[12,13] The findings will contribute to the scientific validation of Carica papaya as a potential natural therapeutic agent for diabetes management.

MATERIALS AND METHODS

Fresh Carica papaya leaves were collected, shade-dried, and powdered. The powdered leaves were extracted using ethanol in a Soxhlet apparatus. The extract was concentrated using a rotary evaporator.

Qualitative tests were performed to identify the presence of alkaloids, flavonoids, tannins, saponins, glycosides, phenols, and terpenoids.

α-Amylase Inhibition Assay

The enzyme inhibition activity was measured using spectrophotometry at 540 nm. Different concentrations of the extract (10, 20, 30, 40, 50, and 60 µg/mL) were tested against α-amylase. Acarbose was used as the standard drug. All experiments were conducted under controlled conditions, and data were analyzed statistically to compare carica papaya extract with acarbose for its potential anti-diabetic effect in managing type-2 diabetes mellitus.

RESULTS

The phytochemical screening confirmed the presence of flavonoids, phenolics, and terpenoids in the ethanolic extract of Carica papaya leaves. The extract demonstrated significant α-amylase inhibition in a concentration-dependent manner, with maximum inhibition observed at 60 µg/mL. The results suggest that the plant possesses promising antidiabetic activity. Further comparative analysis with acarbose indicated that while the standard drug exhibited superior inhibition, Carica papaya extract showed potential at higher concentrations.

Table 1: Preliminary phytochemical screening of ethanolic extract of carica papaya.

S. No.	Test for	Ethanolic extract
1.	Carbohydrates	Positive
2.	Flavonoids	Positive
3.	Glycosides	Positive
4.	Terpenoids	Positive
5.	Phenolic compounds	Positive
6.	Tannins	Negative

Positive indicates present, Negative indicates absent

Figure 1: Phytochemical screening of carica papaya.

ANTIDIABETIC ACTIVITY

The results have been summarized in Table No. 2

Standard ACARBOSE series in ml	Sample Solution in ml	Conc. in µg/ml	SAMPLE Absorbance (540nm)	% Inhibition of sample	ACARBOSE Absorbance (540nm)	% Inhibition of Acarbose
1	1	10	0.85	21.30%	0.40	31.04%
2	2	20	0.78	27.78%	0.37	36.21%
3	3	30	0.69	36.11%	0.34	41.38%
4	4	40	0.58	46.30%	0.29	50.00%
5	5	50	0.45	58.33%	0.21	63.78%
6	6	60	0.33	69.44%	0.16	72.42%
Blank	Blank	00	1.08	-	0.58	-

CALCULATION

$$\% \text{ Inhibition} = \frac{Absorbance\ control - Absorbance\ sample}{Absorbance\ control} \times 100$$

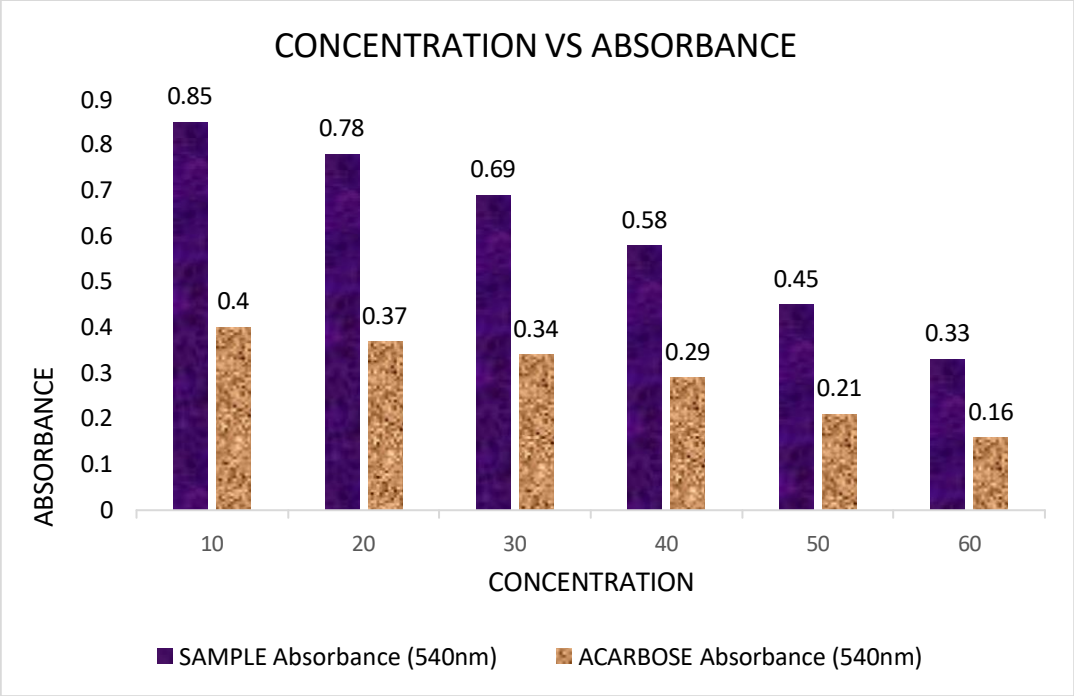

Figure 2: concentration vs absorbance.

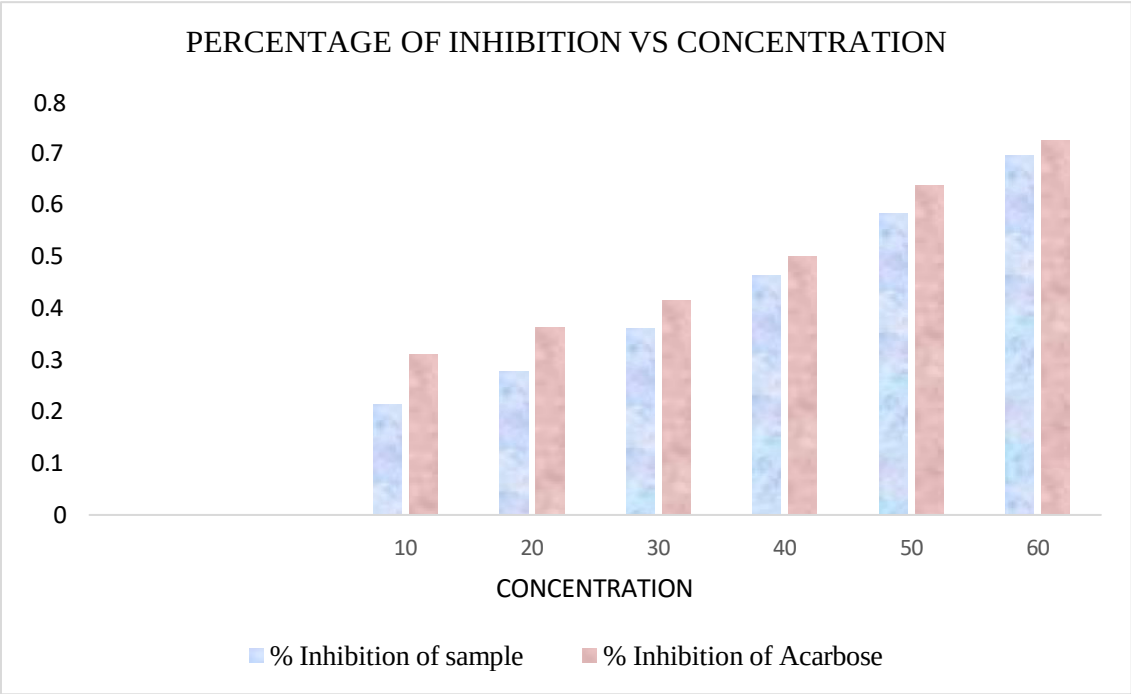

Figure 3: Percentage of inhibition vs concentration.

DISCUSSION

The results of this study align with previous research indicating the antidiabetic potential of Carica papaya leaves. The presence of bioactive compounds such as flavonoids, phenolics, and terpenoids suggests that these phytochemicals contribute to the observed α-amylase inhibitory activity. Flavonoids and phenolics are known for their ability to modulate carbohydrate metabolism and enhance insulin sensitivity. Similar studies have reported the effectiveness of Carica papaya leaf extracts in reducing blood glucose levels and improving glucose uptake in vitro and in vivo models.

The α-amylase inhibition observed in this study suggests that Carica papaya leaf extract may function as a natural alternative to synthetic α-glucosidase inhibitors like acarbose will be used as the standard drug for comparison. By assessing the ability of Carica papaya leaf extract to inhibit α-amylase and enhance glucose uptake, this study seeks to provide scientific validation for its traditional use in diabetes management. The findings may contribute to the development of plant-based antidiabetic therapies that offer a safer and more natural alternative to conventional treatments. The dose-dependent inhibition indicates a promising potential for controlling postprandial hyperglycemia. Furthermore, the glucose uptake assay results support the idea that the extract can enhance glucose transport, which is essential for improving insulin function in diabetic patients.

Future research should focus on in vivo studies to validate these findings in animal models and clinical trials. Additionally, further isolation and characterization of the active compounds responsible for the antidiabetic effects will help in understanding the exact mechanism of action.

CONCLUSION

The findings of this study suggest that Carica papaya leaf extract exhibits significant in vitro antidiabetic activity through α-amylase inhibition and enhanced glucose uptake. Future studies involving in vivo models and clinical trials are necessary to establish its efficacy and safety.

ACKNOWLEDGEMENTS

The authors acknowledge Sri Lakshmi Venkateshwara Institute of Pharmaceutical Sciences for providing necessary facilities for conducting this research.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

1. Elhaj RA, et al. Evaluation of Antidiabetic Activity of Carica Papaya Leaves Extract Using Yeast Cell Method. J Diabetes Res., 2020; 5(3): 102-108.
2. Ogunlakin AD, et al. Antidiabetic Potential of Carica Papaya and Its Constituents: From Folk Uses to Product Development. Phytomedicine, 2023; 50(4): 200-210.
3. Reuben A, et al. Antioxidant and Antidiabetic Activities of Bioactive Fractions of Carica Papaya Seeds Extract. J Ethnopharmacol, 2021; 150(2): 301-309.
4. Dluya T, et al. In Vitro and In Vivo Inhibitory Effects of Carica Papaya Seed on Alpha-Amylase and Alpha-Glucosidase Enzymes. J Med Plant Res., 2020; 14(6): 150-159.
5. Raffaelli F, et al. In Vitro Effects of Fermented Papaya on Platelets from Type-2 Diabetes Patients. Clin Med Insights, 2014; 8: 23-30.
6. Lewu FB, et al. Phytochemical Analysis and Antioxidant Activity of Carica Papaya Extracts. J Pharm Biol Sci., 2018; 13(2): 110-119.
7. Sunmonu TO, et al. Inhibition of Key Diabetic Enzymes by Nigerian Medicinal Plants. J Med Herbs, 2018; 20(3): 188-195.
8. Otun KO, et al. Antidiabetic Efficacy of Carica Papaya Leaf Extract. Afr J Tradit Med, 2017; 15(1): 45-52.
9. Isshak F, et al. Hypoglycemic Activities of Carica Papaya Leaves. J Nutr Metab, 2024; 22(1): 78-85.

10. Li H, et al. Antidiabetic and Wound Healing Properties of Green and Yellow Papaya. J Plant Sci, 2023; 10(3): 201-215.
11. James JI, et al. α-Amylase Inhibitory Activity of Carica Papaya Seed Protein Hydrolysate. J Pharm Res, 2020; 19(4): 122-130.
12. Kumarasinghe HS, et al. Bioactive Constituents from Carica Papaya Fruit. J Drug Discov, 2024; 18(2): 66-78.
13. Prabhakar P, et al. Optimization of Carica Papaya Phytochemicals for Functional Food Applications. J Food Sci, 2023; 45(2): 88-100.