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A STUDY ON THE ANTI-DIABETIC PROPERTIES OF *CATHARANTHUS ROSEUS* AND *PSIDIUM GUAJAVA*

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Abstract

Diabetes mellitus is a metabolic disorder that poses considerable global health challenges. The search for operative therapeutic agents has drawn growing attention in plant-based medications due to their efficacy, fewer side effects, and reasonable costs. *Catharanthus roseus* (commonly known as Madagascar periwinkle) and *Psidium guajava* (guava) are two medicinal plants traditionally used for their antidiabetic properties. These plants have bioactive compounds such as alkaloids, flavonoids, and phenolic acids that modulate metabolic pathways and fight oxidative damage. However, methodical contrasts of their therapeutic ability with standard drugs like Metformin (an antidiabetic) are scarce. This study aims to investigate and compare the antidiabetic activities of periwinkle and guava plant extracts with the standard drug, Metformin. The present work offers a comprehensive assessment of the therapeutic efficacy of periwinkle and guava plant extracts. The methodology used involved antidiabetic tests to evaluate the antidiabetic activity of *Psidium guajava* (guava) and *Catharanthus roseus* (periwinkle) leaf extracts, comparing them with the standard drug, metformin. The results showed considerable anti-diabetic activity in both the plant extracts, *Catharanthus roseus* and *Psidium guajava*. *Catharanthus roseus* displayed the highest anti-diabetic activity, with values decreasing as concentration increased (77.72 mg at 25% and 49.7 mg at 100%). *Psidium*'s anti-diabetic activity was moderate and decreased gradually as concentrations were increased (38 mg at 25 % and 5.26 mg at 100%). The antidiabetic activity reported in *Psidium guajava* was found to be lower than that of *Catharanthus roseus*. The present study demonstrates the anti-diabetes activity in the leaf extracts of periwinkle and guava. By correlating scientific experimentations with traditional knowledge, the present research seeks to contribute to the development of herbal alternatives for managing diabetes.

Key Words: Anti-Diabetic Properties, *Catharanthus Roseus*, Madagascar Periwinkle, *Guava* Leaves, *Psidium Guajava*.

INTRODUCTION

Anti-diabetic agents play a vital role in lowering the blood glucose levels through mechanisms such as improving insulin sensitivity, increasing insulin secretion, reducing glucose absorption, or inhibiting glucose production in the liver. The present research aims to study the anti-diabetic properties of the plants to showcase their therapeutic potential against diabetes. *Catharanthus roseus* and *Psidium guajava* leaves have noteworthy antioxidant properties that can neutralise the free radicals and exhibit anti-inflammatory activity by reducing inflammation-related markers. They modulate carbohydrate metabolism, thereby mitigating hyperglycaemic states. Medicinal plants such as *Catharanthus roseus* and *Psidium guajava* counteract free radicals while exhibiting concurrent anti-inflammatory and antidiabetic properties, valuable for managing various metabolic disorders. Metabolic diseases are a growing concern worldwide, with a significant impact on public health. According to the World Health Organization (WHO), approximately 422 million people worldwide suffer from diabetes, with the prevalence expected to rise to 578 million by 2030 (World Health Organization, 2016). Diabetes is a condition that increases the risk of cardiovascular disease and **stroke**, affecting an estimated 20–30% of the global adult population (International Diabetes Federation (IDF)(2019). The prevalence of metabolic diseases is a major health concern, with different rates reported across regions, age groups and genders. A comprehensive understanding of these disparities is fundamental to establishing tailored prevention and management strategies

Regional Variations

The prevalence of metabolic diseases differs significantly across regions. In the United States, diabetes affects 11.3% of the population, while metabolic syndrome is estimated to affect one in three American adults (Centers for Disease Control and Prevention, 2020; Ford *et al.*, 2002). Abohashem *et al.* (2025) examined trends confirming that metabolic syndrome impacts approximately 39% (nearly four in ten) of US adults. Jafar, *et al.*(2008) reported prevalence of metabolic syndrome



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in urban Pakistan (Karachi). Shafique *et al.* (2018). Conducted a review of the prevalence of metabolic syndrome in Pakistan. Adil *et al.*, (2023) investigated regional disparities in metabolic syndrome within Pakistan in different geographic settings, with exceptionally high prevalence rates recorded in the heavily urbanised Sindh province (63.7%) and within transitional suburban villages in Punjab province (68%) The prevalence of metabolic diseases among suburban populations was high compared to that of urban residents. These variations indicate region specificity in the metabolic diseases.

Age and Gender Differences

Age and gender also play a significant role in the prevalence of metabolic diseases. A study in China found that the prevalence of metabolic syndrome increased with age, from 11.1% in those aged 20-29 years to 44.8% in those aged 60-69 years (Gu *et al.*, 2005). The prevalence of metabolic diseases was higher among older adults than in younger people. Additionally, women are more likely to develop metabolic syndrome than men, with a study in Iran reporting a prevalence of 34.6% in women compared to 23.1% in men (Azizi *et al.*, 2003). These findings suggest that the prevalence of metabolic diseases is higher in women than in men. Two major aspects in age and gender differences are aged people and women are more likely to get metabolic diseases. An analysis of demographic disparities (age and gender differences) reveals that advanced age and female sex are major risk factors for metabolic diseases.

Diabetes mellitus

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by hyperglycemia resulting from impaired insulin secretion, insulin resistance or both. It is a major global health concern with increasing prevalence linked to sedentary lifestyles, obesity and aging populations. Diabetes is broadly classified into type 1 diabetes (T1D), an autoimmune condition leading to the destruction of pancreatic β -cells and type 2 diabetes (T2D), which is primarily associated with insulin resistance and relative insulin deficiency (American Diabetes Association, 2020).

Traditional medicines, such as Guava leaves and *Catharanthus* have been used for centuries to treat various diseases including diabetes, inflammation and oxidative stress. Here are some of the potential roles of these traditional medicines. *Guava* and *Catharanthus* leaves have been shown to have antidiabetic properties, reducing blood sugar levels and improving insulin sensitivity (Ojewole, 2006); Chakrabarti *et al.* (2003). Phyto derivatives are compounds derived from plants, which have been modified or processed to create new substances with potential therapeutic benefits. Phytoderivatives have gained immense significance in modern medicine due to their diverse pharmacological properties and their potential to address complex health challenges. These plant- derived compounds, such as alkaloids, flavonoids, terpenoids and polyphenols have been extensively studied for their therapeutic efficacy in treating chronic diseases including cancer, diabetes, cardiovascular disorders and neurodegenerative conditions. Their natural origin, low toxicity and ability to modulate multiple biological pathways make them attractive alternatives or adjuncts to synthetic drugs. For instance, phytoderivatives like curcumin, resveratrol and quercetin have demonstrated potent anti-inflammatory, antioxidant, and anticancer activities, offering promising avenues for drug development (Patel *et al.*, 2020). Moreover, phytoderivatives are increasingly being integrated into personalized medicine and nutraceuticals, addressing the growing demand for holistic and preventive healthcare. Their role in combating antimicrobial resistance is also noteworthy as many plant-derived compounds exhibit broad-spectrum antimicrobial activity against drug-resistant pathogens (Sharma *et al.*, 2020). New advancements in biotechnology and nanotechnology have enabled the development of novel drug delivery systems, enhancing the therapeutic efficacy of phytoderivatives (Kumar *et al.*, 2020). Thus phytoderivatives represent a cornerstone in the transition towards sustainable, effective and patient-centric medical solutions. Phytoderivatives with their dual anti-inflammatory and antioxidant properties have shown potential in mitigating these pathological processes offering a natural and sustainable approach to diabetes management (Prasad *et al.*, 2020). Below is an overview of these Plant extracts:



Table-1 Plant Sources and Their Bioactive Compounds with Anti-diabetic Properties

S.No.	Bioactive Compounds:	Anti-diabetic Properties
<i>Guava</i> Leaves (<i>Psidium guajava</i>)	Quercetin, gallic acid, catechin and flavonoids.	<i>Guava</i> leaf extracts enhance glucose uptake and improve insulin sensitivity, making them effective in managing type 2 diabetes (Eidenberger <i>et al.</i> , 2019).
<i>Catharanthus roseus</i> (Madagascar Periwinkle)	Vincristine, vinblastine and other indole alkaloids.	The plant's alkaloids improve insulin sensitivity and reduce hyperglycemia by modulating glucose metabolism (Singh <i>et al.</i> , 2019).

RESEARCH METHODOLOGY

Collection of Plant Leaves: To study the anti-inflammatory activity in the leaf extract, periwinkle (*Catharanthus*) and Guava (*Psidium*) leaves were collected in Hyderabad.(Figure.1)

Preparation of extracts: washed with tap water, and dried in a hot air oven at 55°C for 24 hours. The dried leaves were then ground into a fine powder. For the extraction process, 20g of *Catharanthus* leaf powder was mixed with 200 ml of distilled water, while 30g of Guava leaf powder was mixed with 300 ml of distilled water. The mixtures were placed in a water bath at 100°C for 2 hours, with periodic stirring. After extraction, the mixtures were filtered using Whatman No. 1 filter paper into conical flasks, covered with aluminum foil, and stored in the refrigerator.

Procedure of Anti-diabetic test(Vogel, 2008):

500 µl Plant extract is added to 500µl PBS (0.2m) α-amylase.

It is further incubated for 10 min at 25°C.

Pre-incubation of 500µl of 1% starch in 0.2 m PBS was added in 3 different concentrations.

Incubate it at 25°C for 10 mins. 1 ml of DNS reagent was added

Add 10 ml of water after the samples cool down

Take OD at 540 nm.

RESULTS

The results show considerable Anti-diabetic activity of the plant extracts.

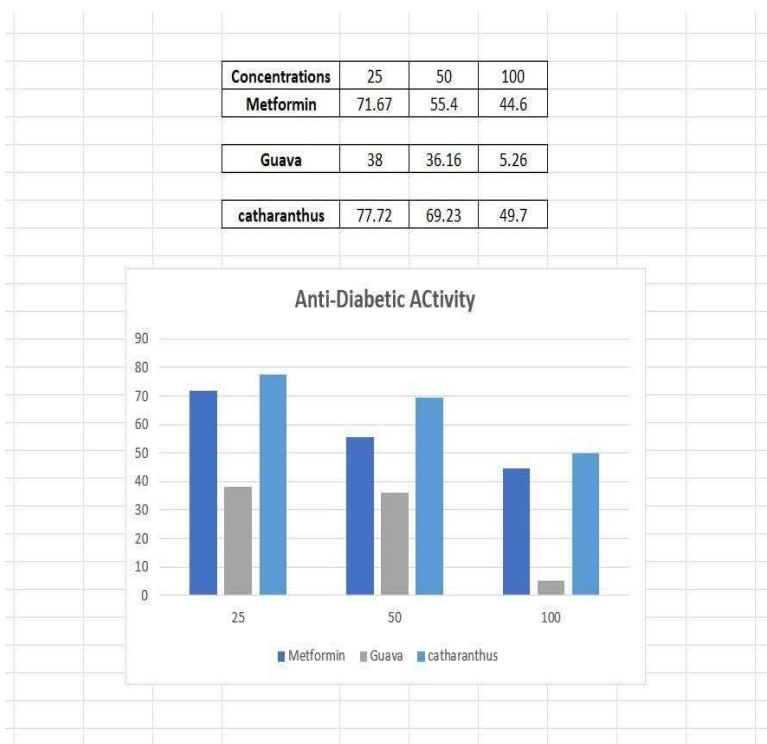
- Catharanthus roseus* also displayed the highest anti-diabetic activity, with values diminishing as concentration increased: 77.72 mg at 25% and 49.7 mg at 100%.(Graph-1).
- Metformin exhibited slightly lower activity than *Catharanthus* at lower concentrations (71.67 mg at 25%) but demonstrated greater stability across varying concentrations.(Graph-1).
- Guava's anti-diabetic activity was significantly lower, particularly at 100% concentration (5.26 mg).(Graph-1).



Figure-1 periwinkle



guava



x-axis: Concentrations of leaf extracts and Metformin at 25% , 50% and 100 % , y-axis: Anti-diabetic activity in mg.

Graph-1: Anti-Diabetic activity

DISCUSSION

The results of the present study have demonstrated significant therapeutic potential of the leaf extracts of Periwinkle and Guava due to their anti-diabetic properties.

1. *Catharanthus* possessed highest anti-diabetic properties due to its alkaloid content, while guava's lesser effectiveness at higher concentrations may relate to its role in enhancing glucose metabolism. *Catharanthus roseus* is widely recognized for its hypoglycemic effects. It contains alkaloids such as vincristine and vinblastine, as well as flavonoids and tannins, which enhance insulin secretion, improve glucose uptake, and inhibit gluconeogenesis. Studies have shown that its aqueous and ethanolic extracts significantly reduce blood glucose levels in diabetic models. Singh *et al.*(2019) found *Catharanthus* plant's alkaloids improved the sensitivity of insulin and reduced hyperglycemia by modulating metabolism of glucose. The results of the present study and the literature supports the fact that periwinkle leaves are effective medical herb for diabetes.



2. *Guava Leaves (Psidium guajava)*: Anti-diabetic activity was found in Guava. This anti-diabetic activity is attributed to compounds like quercetin, guaijaverin and flavonoids *Guava* leaves are known for their anti-hyperglycemic effect,. These compounds inhibit α -amylase and α -glucosidase enzymes, reducing carbohydrate absorption and improving insulin sensitivity. Clinical studies have demonstrated their efficacy in lowering blood glucose levels in diabetic patients. Presence of anti-diabetic activity in Guava in various concentrations. These results depicts that Anti-diabetic activity is present in Guava indicating the medicinal properties of leaves of Guava. Eidenberger *et al.*, (2019) reported studies on the leaf extracts of Guava which enhanced uptake of glucose and helped in improved sensitivity of insulin. Subsequently, Guava leaf extracts were effective in managing type-2 diabetes.
3. Guava's anti-diabetic activity was significantly lower when compared to *Catharanthus* and the standard at different concentration(25% and 50 %) and lowest at 100% concentration. However, higher anti-diabetic activity in *Catharanthus* denotes presence of more bioactive compounds in the leaf extracts of *Catharanthus* denoting a efficient herbal medicinal herb for Diabetes.
4. Plants such as *Catharanthus roseus* (Madagascar periwinkle) and *Psidium guajava* (guava) leaves (have gained significant attention for their therapeutic potential in managing diabetes. Both plants are rich sources of bioactive compounds that contribute to their multi-functional health benefits. The present study de monstrates the presence of antidiabetic activity in *Psidium guajava* (guava) extracts and *Catharanthus roseus* across various concentrations. These results depict that the antidiabetic potency of the extract operates in a dose-dependent manner.

A hallmark of diabetes is the persistent state of low-grade inflammation which plays a critical role in the pathogenesis and progression of the disease. Chronic hyperglycemia triggers the activation of pro-inflammatory pathways leading to the release of inflammatory cytokines. This inflammatory milieu contributes to insulin resistance, β -cell dysfunction and the development of diabetic complications including cardiovascular disease, nephropathy and neuropathy (Donath & Shoelson, 2011). Oxidative stress, characterized by an imbalance between the production of reactive oxygen species (ROS) and the body's antioxidant defences is another key player in diabetes. (Giacco & Brownlee, 2020). Through therapeutic interventions, such as anti-diabetic herbal medicines and lifestyle modifications, a promising strategy has emerged for managing diabetes and its complications.

CONCLUSION

In the present study, the antidiabetic properties of *Catharanthus roseus* (periwinkle) and *Psidium guajava* (guava) leaf extracts were evaluated and compared against the standard drug, metformin. Consequently, they offer plant-derived alternatives to combat diseases associated with antidiabetic responses. The results indicated that both periwinkle and guava had anti-diabetic activity. However, the *Catharanthus roseus* (periwinkle) extract exhibited the highest antidiabetic activity. Ultimately, these findings confirm that both *C. roseus* and *P. guajava* serve as rich bio-reserves for natural anti-inflammatory compounds. In summary, the current investigation substantiates the status of these common plant extracts as highly effective, naturally derived anti-inflammatory agents.

References:

1. Abohashem, S., Hassan, I., Wasfy, J. H., & Taub, P. R. (2025). Trends and prevalence of the metabolic syndrome among US adults. *JAMA*, 334(23), 2341–2348.
2. Adil, S. O., Islam, M. A., Musa, K. I., & Shafique, K. (2023). Prevalence of metabolic syndrome among apparently healthy adult population in Pakistan: A systematic review and meta-analysis. *Healthcare*, 11(4), 531.
3. American Diabetes Association. (2020). Standards of medical care in diabetes—2020. *Diabetes Care*, 43(Suppl. 1), S1–S212. Diabetes Care Portal.
4. Azizi, F., et al. (2003). Prevalence of metabolic syndrome in an urban population in Tehran, Iran. *Diabetes Research and Clinical Practice*, 61(1), 29-37.



5. Centers for Disease Control and Prevention. (2020). *National diabetes statistics report, 2020*. U.S. Department of Health and Human Services. CDC Report
6. Chakrabarti, R., *et al.* (2003). Antidiabetic and antihyperlipidemic activity of *Catharanthus roseus*. *Journal of Ethnopharmacology*, 89(1), 11-16.
7. Donath, M. Y., & Shoelson, S. E. (2011). Type 2 diabetes as an inflammatory disease. *Nature Reviews Immunology*, 11(2), 98–107. Nature Portal
8. Eidenberger, T., Selg, M., & Krennhuber, K. (2013). A key to the beneficial effects of guava in type II diabetes mellitus. *Fitoterapia*, 89, 215-222.
9. Ford, E. S., Giles, W. H., & Dietz, W. H. (2002). Prevalence of the metabolic syndrome among US adults: Findings from the Third National Health and Nutrition Examination Survey. *JAMA*, 287(3), 356–359.
10. Giacco, F., & Brownlee, M. (2020). "Oxidative stress and diabetic complications." *Circulation Research*, 107(9), 1058-1070.
11. Gu, D., *et al.* (2005). Prevalence of metabolic syndrome and its components in the Chinese adult population. *Diabetes Research and Clinical Practice*, 69(2), 148-155.
12. International Diabetes Federation. (2019). *IDF diabetes atlas* (9th ed.). International Diabetes Federation. IDF Atlas Portal.
13. Jafar, T. H., Chaturvedi, N., & Pappas, G. (2008). Prevalence of metabolic syndrome in urban Pakistan (Karachi): Comparison of newly proposed International Diabetes Federation and modified Adult Treatment Panel III criteria. *Journal of the Pakistan Medical Association*, 58(10), 531–536.
14. Kumar, R., *et al.* (2020). Phytoderivatives in Modern Medicine: A Review of Their Pharmacological Potential. *Phytotherapy Research*, 34, (8): 1789–1805.
15. Ojewole, J. A. (2006). Hypoglycemic effect of *Psidium guajava* leaves in rats. *Methods and Findings in Experimental and Clinical Pharmacology*, 28(6), 331-336.
16. Patel, S., Sharma, V., and Singh, K. (2020). Therapeutic potential of phytoderivatives in chronic disease management. *Journal of Ethnopharmacology*, 250, Article 112456.
17. Prasad, S., Srivastava, S. K., & Singh, M. (2020). Phytoderivatives in diabetes management: Targeting inflammation and oxidative stress. *Journal of Diabetes Research*, 2020, Article 8839215, 1–12.
18. Shafique, K., *et al.* (2018). Prevalence of metabolic syndrome in Pakistan: A systematic review and meta-analysis. *Journal of Clinical and Diagnostic Research*, 12(9), OE01-OE06.
19. Sharma, A., Gupta, P., and Kumar, R. (2020). Phytoderivatives as a solution to antimicrobial resistance: A review. *Phytomedicine*, 70, Article 153231.
20. Singh, S., Kumar, A., & Sharma, B. (2019). Evaluation of antidiabetic and insulin-sensitizing mechanisms of *Catharanthus roseus* alkaloids via modulation of glucose metabolism. *Phytomedicine*, 56, 122–131.
21. Vogel, H. G. (Ed.). (2008). *Drug discovery and evaluation: Pharmacological assays* (3rd ed.). Springer.
22. World Health Organization. (2016). *Global report on diabetes*. World Health Organization.