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A STUDY OF THE ANTI-OXIDANT PROPERTIES IN LEAF EXTRACTS OF *CATHARANTHUS ROSEUS* (PERIWINKLE) AND *PSIDIUM GUAJAVA* (GUAVA)

Jyothirmmai, G.S

Associate Professor, Department of Zoology, Government College for Women, Osmania University, Begumpet, Hyderabad, India

ABSTRACT

Oxidative stress is a metabolic condition that causes considerable health issues. The quest for effective treatment options has sparked greater interest in herbal remedies because of their efficacy, low side effects, and affordability. *Catharanthus roseus* (widely known as Madagascar periwinkle) and *Psidium guajava* (guava) are two herbal plants historically used for their anti-inflammatory and antioxidant benefits. These plants contain numerous bioactive compounds such as alkaloids, flavonoids, and phenolic acids that could influence metabolic pathways and combat oxidative stress. However, studies on methodical comparison of their therapeutic potential with standard drugs, Vitamin C (antioxidant) are limited. The present research seeks to analyse and compare the antioxidant properties of extracts from *Catharanthus* and *Psidium* plants with standard antioxidant, Vitamin C, contributing to an extensive evaluation of their therapeutic benefits. The Methodology for evaluating the phytoderivatives was an *in vitro* antioxidant test. The findings indicated that extracts from both guava leaves and periwinkle leaves exhibited antioxidant capabilities. In addition, *Psidium* (guava) leaf extract exhibited significantly stronger antioxidant properties than *Catharanthus* (periwinkle) extract. These findings endorse the possible advancement of these plant extracts into natural therapeutic products.

Key Words: Phytoderivatives, reactive oxygen species (ROS), oxidative stress, *Catharanthus roseus*, *Psidium guajava*.

INTRODUCTION

Phytoderivatives are bioactive compounds or extracts derived from plants, including leaves, stems, roots, flowers, and seeds. It includes alkaloids, glycosides, flavonoids, terpenes and saponins. These compounds have been shown to possess anti-oxidant, anti-inflammatory, anti-microbial, anti-diabetic and anti-cancerous properties.(Altemimi *et al.* (2017), Kaur and Mondal (2024), Sok Yen *et al.* (2023), Yadav *et al.*(2022). Phytoderivatives are being explored for their potential use in the prevention and treatment of various diseases, including diabetes, cancer, cardiovascular disease, and neurodegenerative disorders. (Ganesan *et al.* (2024), Haines (2024), Liu *et al.* (2025), Sharifi-Rad *et al.*(2026). Advances in extraction and purification technologies, such as supercritical fluid extraction and nanotechnology, have enhanced the bioavailability and efficacy of these compounds in recent years (Smith *et al.*, 2020). Plants such as *Catharanthus roseus* (Madagascar periwinkle) and *guava* leaves (*Psidium guajava*) have gained significant attention for their therapeutic potential in managing diabetes, inflammation, and oxidative stress. Both plants are rich sources of bioactive compounds that contribute to their multi-functional health benefits. The present investigation is to compare the antioxidant potential of periwinkle and guava plant extracts with standard drug (Vitamin C) to assess their therapeutic properties.

Phytoderivatives like curcumin, resveratrol and quercetin have demonstrated potent antioxidant properties, offering promising avenues for drug development (Patel *et al.*, 2020). Moreover, phytoderivatives are increasingly being integrated into 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). Additionally, advancements in biotechnology and nanotechnology have enabled the development of novel drug delivery systems, enhancing the bioavailability and therapeutic efficacy of phytoderivatives (Kumar *et al.*, 2020). Thus, phytoderivatives represent a cornerstone in the transition towards sustainable, effective and patient-centric medical solutions.

Anti-oxidant Properties of the leaf Extract of the following are:

1. Periwinkle leaves (*Catharanthus roseus*): *Catharanthus roseus* is rich in anti-oxidants such as flavonoids and phenolic compounds, which scavenge free radicals, reduce oxidative stress, and protect tissues from damage caused by reactive oxygen species (ROS). (Pandey *et al.*, 2019).
2. Guava Leaves (*Psidium guajava*): The leaves are rich in polyphenols, vitamin C and flavonoids, which exhibit strong anti-oxidant activity. They neutralize free radicals, reduce lipid peroxidation, enhance the activity of endogenous anti-oxidant enzymes like superoxide dismutase (SOD) and catalase. (Gutiérrez *et al.* (2008), Zhang *et al.* (2021).

Both *Catharanthus roseus* and *guava* leaves demonstrate significant potential as natural therapeutics for managing oxidative stress. Their multi-target mechanisms of action coupled with their safety and accessibility make them promising candidates for further research and development of plant-based treatments. This review highlights the need for standardized extracts, detailed pharmacological studies and clinical trials to fully harness their therapeutic potential.

Oxidative stress, characterized by an imbalance between the production of reactive oxygen species (ROS) and the body's antioxidant defenses is another key player in diabetes.(Giacco and Brownlee, 2010). Hyperglycemia-induced ROS generation occurs through multiple mechanisms including the polyol pathway, advanced glycation end products (AGEs) formation and mitochondrial dysfunction. (Luc *et al.*, 2023). Excessive ROS damages cellular components such as DNA, proteins and lipids, exacerbating insulin resistance and β -cell apoptosis. (Volpe *et al.*,2018). Furthermore,



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oxidative stress and inflammation are interconnected as ROS can activate inflammatory pathways and inflammatory cytokines can further amplify oxidative stress creating a vicious cycle that perpetuates diabetic complications (Giacco and Brownlee, 2010). Addressing inflammation and oxidative stress through therapeutic interventions, such as antioxidants, anti-inflammatory agents and lifestyle modifications has emerged as a promising strategy for managing diabetes and its complications. (Burgos-Morón *et al.* 2019), Sukumaran *et al.*(2024), Zimmet *et al.*(2022)

Phytochemicals 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). Wang *et al.*(2023) carried out work on the phytochemicals like quercetin, curcumin and EGCG exhibiting potent antioxidant properties, scavenging ROS and reducing oxidative stress. This in turn, suppresses the activation of inflammatory pathways, leading to decreased production of pro- inflammatory mediators. Oxidative stress was closely linked to inflammation as reactive oxygen species (ROS) can activate NF- κ B, COX and LOX pathways. (Wang *et al.*,2023)

Medicinal Properties of Antioxidants:

- Cell Protection: Anti-oxidant phytochemicals shield cells from damage caused by free radicals, reducing oxidative stress. (Tumilaar, 2024).
- Aging and Disease Prevention: Anti-oxidants help prevent age-related diseases, such as wrinkles, age spots, and chronic conditions like cancer, diabetes, and neurodegenerative disorders.(Michalak,2022, Leyane *et al.*,2022).
- Boosting Immune System: Anti-oxidant phytochemicals support immune function, enhancing the body's natural defense against infections and diseases. (Achieng, 2026).

RESEARCH METHODOLOGY

Collection of Plant Leaves: To study the antioxidant 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 (Figure-2).

Procedure of Antioxidant Test: Prepare 25%, 50%, 100% concentrations. Add 800 μ l TRIS-HCL buffer to each concentration. Add 1000 μ l DPPH((2,2-diphenyl-1-picrylhydrazyl) solution. Take initial readings using colorimeter at 530nm. Measure readings after 30 mins, and final readings at 60 mins. Compare antioxidant activity with standard drug, Vitamin-C.(Armstrong, 2008)(Figure-2,3).

RESULTS

In the present study two leaf extracts were taken. These were the leaf extracts of periwinkle (*Catharanthus roseus*) and guava (*Psidium guajava*)(Figure-1, Table-1). The classification of periwinkle and guava is seen in Table-1. The present study investigates the antioxidant activity of Vitamin C, guava (*Psidium guajava*), and *Catharanthus roseus* across different concentrations (25%, 50%, and 100%) over two time intervals (30 minutes and 60 minutes)(Table-2, Figure-2, 3, Graph-1, 2, 3).

Vitamin C demonstrated superior antioxidant activity consistently across all concentrations and time points.(Table-2, Graph-1, 2, 3) *Guava* exhibited moderate antioxidant properties, slightly lower than Vitamin C but consistently higher than *Catharanthus* at most concentrations.(Table-2, Graph-1, 2, 3). This correlates with previous research indicating that guava is rich in polyphenols, flavonoids and Vitamin C, all of which enhance its antioxidant capacity. Notably, *Catharanthus* showed elevated antioxidant activity at lower concentrations (25%) but exhibited improved performance at higher concentrations (100%) after a 60-minute period.(Table-2, Graph-1, 2, 3), while Vitamin C's antioxidant activity remained stable, both *Guava* and *Catharanthus* experienced a slight decline over the 60-minute measurement period.(Table-2, Graph-1, 2, 3).



Table-1. Classification of Periwinkle and Guava (APG IV,2016)

Name	<i>Catharanthus roseus</i> (Madagascar Periwinkle)	<i>Psidium guajava</i> (Guava)
Classification	Scientific Classification: Kingdom: Plantae Phylum : Angiosperms Class : Eudicots Order : Gentianales Family : Apocynaceae Genus : <i>Catharanthus</i> Species : <i>Catharanthus roseus</i>	Scientific Classification: Kingdom: Plantae Phylum : Angiosperms Class : Eudicots Order : Myrtales Family : Myrtaceae Genus : <i>Psidium</i> Species : <i>Psidium guajava</i>

Figure-1, Leaves of Periwinkle(*Catharanthus roseus*) and Guava(*Psidium guajava*)



Catharanthus



Guava

Figure-2, Preparation of the leaf extracts



Figure-3. Chemicals Used in Anti Oxidant Test

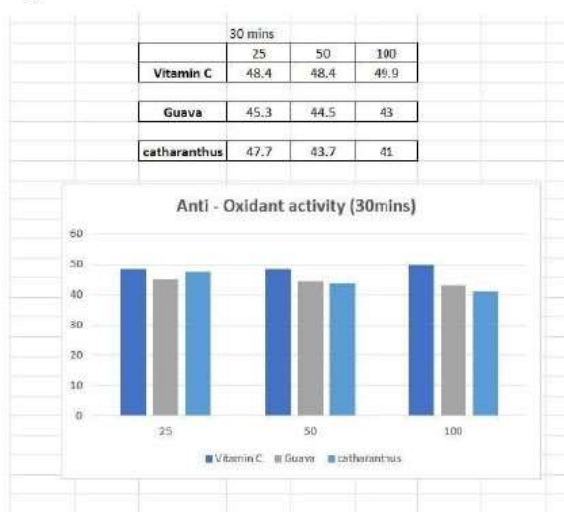




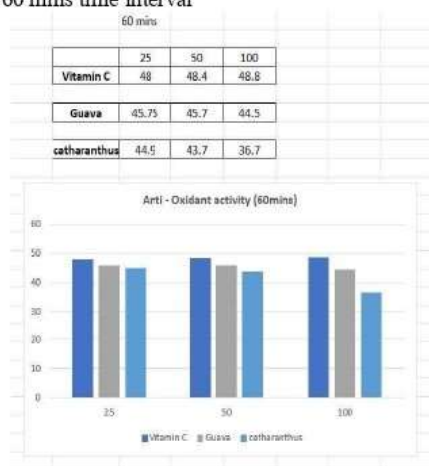
Table-2, Anti-Oxidant Activity

Concentrations	Guava & periwinkle extracts separately	Ethanol	Tris HCL	DPPIH	Initial readings were taken in 0 mins	Initial readings were taken in 30 mins	Initial readings were taken in 60 mins
25%	50 µl	150 µl	800 µl	1000 µl			
50%	100 µl	100 µl	800µl	1000 µl			
100%	200 µl	No Ethanol	800µl	1000 µl			

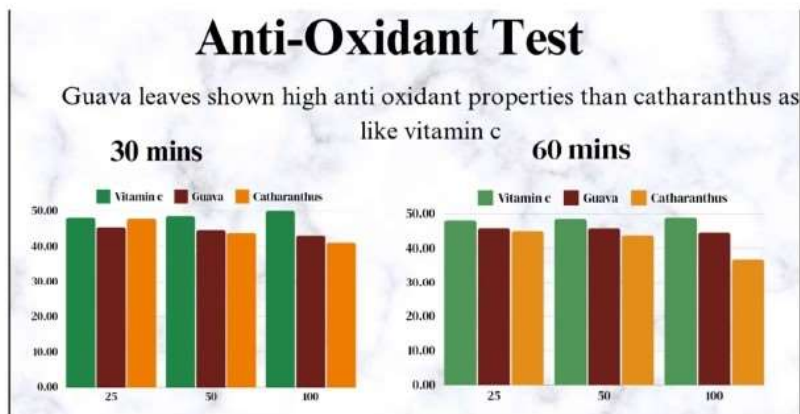
Graph-1: Anti-oxidant activity for 30 mins time interval



Graph-2: Anti-oxidant activity for 60 mins time interval



Graph-3 Anti-Oxidant Test



DISCUSSION

Phytoderivatives from Guava and Periwinkle leaf extracts have demonstrated significant therapeutic potential due to their antioxidant properties.

- Guava (*Psidium guajava*)**: In the present study, both guava leaves and periwinkle leaves extract products showed antioxidant properties. However, higher antioxidants have been found in the leaf extract of guava than leaf extract of periwinkle. The results suggest that guava leaves have more antioxidant properties than the leaves of periwinkle. Irondi *et al.*, (2016) worked on the in vitro studies and the extracts of guava plant and found poly phenolic rich compounds present which inhibited vital enzymes implicated in gout and hypertension. Studies by Gutiérrez *et al.* (2008) have found high flavonoid and polyphenol content in *guava* leaves which scavenges the reactive oxygen species (ROS) and reduces oxidative stress. Bioactive Compounds like Quercetin, gallic acid, catechin and flavonoids were found in guava leaves. The elevated levels of antioxidants have been observed in leaf extract of guava plant in the current investigation. This correlates with previous research indicating that guava is rich in polyphenols, flavonoids and Vitamin C, all of which enhance its antioxidant capacity.
- Periwinkle (*Catharanthus roseus*)**: Pandey *et al.* (2019) reported alkaloids and phenolic compounds in *Catharanthus roseus* exhibiting strong free radical scavenging activity, protecting cells from oxidative damage. They have found bioactive compounds like vincristine, vinblastine and other indole alkaloids. Literature indicates that *Catharanthus roseus* contains alkaloids and flavonoids with antioxidant potential, However, their efficacy may diminish over time due to oxidative stress. The present investigation corroborates previous research and demonstrates substantial antioxidant activity within *Catharanthus roseus*.

Zhang *et al.* (2021) investigated about phytoderivatives and their response to oxidative stress. They found that the compounds in the phytoderivative were responsible for enhancing the activity of endogenous antioxidant enzymes, such as superoxide dismutase (SOD) and glutathione peroxidase (GPx), further protecting beta-cells from oxidative stress. Phytoderivatives such as curcumin, quercetin and epigallocatechin gallate (EGCG) were found to exhibit potent antioxidant properties, scavenging reactive oxygen species (ROS) and reducing oxidative damage to beta-cells. (Guan and Wang (2021), Li *et al.* (2022), Sukumaran and Subramani (2025). Studies by Kumar *et al.*, (2022) examined the role of phytoderivatives in inhibition of apoptosis. Phytoderivatives such as flavonoids, alkaloids and polyphenols inhibit beta-cell apoptosis by modulating apoptotic signaling pathways. Quercetin and EGCG upregulated anti-apoptotic proteins like Bcl-2 and downregulated pro-apoptotic proteins like Bax and caspase-3, promoting beta-cell survival (Guan and Wang (2021), Martínez-Castillo and Recio (2019), Sun and Zhang (2024). The research studies by various researchers and the present study indicate that the phytoderivatives from leaf extracts of periwinkle and guava have been effective in providing anti-inflammatory and antioxidant benefits. These results aid the development of these plant extracts into natural therapeutic agents.

CONCLUSION

In the present research, analyses of the antioxidant profiles of *Catharanthus roseus* (Periwinkle) and *Psidium guajava* (Guava leaves) extracts, using Vitamin C as a positive reference standard was dealt. The results indicated that both organic samples possess high efficacy in neutralizing free radicals due to their high concentration of active phytochemicals. Although the standard drug (Vitamin C) maintained the strongest overall antioxidant response, the plant extracts displayed powerful, dose-dependent activity that confirms the validity of their traditional medicinal uses. In conclusion, this study verifies that these common botanical sources are valuable origins for natural biological



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antioxidants. Consequently, they offer viable starting points for creating safe, plant-derived alternatives to combat diseases associated with cellular oxidative stress.

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