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Research Article

The role of *Psidium guajava* L. fruits in mitigating oxidative stress: from diet to therapeutics

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Abstract: *Psidium guajava* L., commonly known as guava, is a tropical fruit enriched with polyphenols, flavonoids, tannins and ascorbic acid, all of which contribute to its impressive antioxidant properties. Oxidative stress, which is caused by an overload of reactive oxygen species (ROS), is linked to many chronic diseases, making natural sources of antioxidants particularly valuable for therapeutic purposes. The present study investigates the radical scavenging ability of *P. guajava* fruit extracts, which were prepared using three different solvent systems: n-hexane, ethanolic and aqueous. The current investigation assessed their effectiveness through a DPPH assay at concentrations ranging from 0.125 to 1.0 mg/ml. The ethanolic extract showed the most significant inhibition, ranging from 82.36% to 95.69%, followed by the aqueous extract at 58.70% to 67.09% and the n-hexane extract at 46.45% to 58.27%. These results underscore the importance of solvent polarity in extracting bioactive phenolic compounds. Overall, these findings suggest that *P. guajava* could serve as a promising dietary and nutraceutical option for managing conditions related to oxidative stress, highlighting the need for further in vivo and clinical studies.

Keywords: Antioxidant, chronic diseases, nutraceutical, polyphenols, therapeutic purposes

Introduction

Oxidative stress is a key biochemical process that happens when there's an imbalance between the overproduction of reactive oxygen species (ROS) and the body's natural ability to defend itself with antioxidants (Pizzino et al., 2017; Liu et al., 2025). ROS, which include superoxide radicals, hydrogen peroxide and hydroxyl radicals, are normal byproducts of how our cells work. But when they accumulate too much, they can cause serious damage to lipids, proteins and nucleic acids, throwing normal cell function out of whack (Rauf et al., 2023). This oxidative stress is closely linked to the onset and progression of a wide range of chronic and degenerative diseases, such as type 2 diabetes, heart problems, neurodegenerative diseases like Alzheimer's and Parkinson's, inflammatory conditions and

various cancers (Leyane et al., 2022; Dash et al., 2024). As these non-communicable diseases become more common worldwide, there's been a growing scientific effort to find effective, safe and sustainable antioxidant solutions (Soodejani, 2024). While our bodies do have their own antioxidant systems like superoxide dismutase, catalase and glutathione peroxidase - these defenses often fall short when faced with ongoing oxidative stress (Jomova et al., 2024; Altanam et al., 2025). Synthetic antioxidants, such as butylated hydroxytoluene (BHT) and butylated hydroxyanisole (BHA), have been commonly used in food and pharmaceuticals. However, increasing worries about their potential toxicity and long-term safety have led researchers to explore plant-based natural antioxidants instead (Antonczyk et al., 2023; Ren et al., 2025). Phytochemicals from fruits, vegetables and medicinal herbs present a promising alternative, offering strong free radical-fighting abilities along with good safety profiles and wide availability (Kumar et al., 2023).



Figure 1: Leaves and flowers of *P. guajava*

Among the various plant sources being studied, *Psidium guajava* L., commonly known as guava has really caught the eye of scientists (Butt et al., 2025). This fruit, which belongs to the Myrtaceae family, is originally from tropical America but is now grown in many parts of Asia, Africa and the Caribbean (Kumar et al., 2021). Guava stands out as one of the most important tropical fruits, both economically and nutritionally. It has long been a key player in traditional medicine across different cultures, often used to treat issues like diarrhea, wounds, fever and inflammation (Gutierrez-Montiel et al., 2023). Recent phytochemical studies have shown that guava fruit is abundant with bioactive compounds, such as polyphenols, flavonoids, tannins, carotenoids and ascorbic acid - all of which are known for their strong antioxidant, anti-inflammatory and protective properties (Choi and Shin, 2025). The antioxidant power of *P. guajava* is significantly affected by the extraction method and the type of solvent used, as the polarity of the solvent influences which phytochemicals are extracted (Thorat and Pangrikar, 2025). When researchers evaluated guava fruit extracts using the DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavenging assay; a well-established and reliable in vitro antioxidant test - they found a clear ranking of activity based on the solvent systems used (Mazumder et al., 2023). Ethanol extracts consistently showed the highest inhibition, achieving an impressive 95.69% at a concentration of 1.0 mg/ml and still maintained a strong activity of 82.36% even at the lowest concentration tested, which was 0.125 mg/ml. This outstanding performance is likely due to ethanol's moderate polarity, allowing it to effectively extract both polar and moderately polar phenolic compounds. On the other hand, aqueous extracts showed moderate scavenging activity, ranging from 58.70% to 67.09%, thanks to water-soluble antioxidants like vitamin C and hydrophilic tannins. In contrast, n-hexane extracts had lower activity (46.45–58.27%), which aligns with the fact that they mainly contain non-polar lipophilic compounds, such as terpenoids and carotenoids. Despite a growing body of literature documenting the in vitro antioxidant properties of *P. guajava*, present study still lacks a clear understanding of how it works, which parts are most effective and how it can be translated from a dietary source to therapeutic use. The present study seeks to fill that gap by thoroughly reviewing the antioxidant capabilities of *P. guajava* fruits, combining data on extract activity with phytochemical insights and looking at the wider implications for its role in preventing and managing diseases related to oxidative stress.

Methodology

The present study is based on field surveys, experimental analyses and an extensive review of published literature pertaining to *P. guajava*. Scientific databases, including Google Scholar, Scopus, PubMed and Web of Science, were consulted to retrieve peer-reviewed research articles, review papers, ethnobotanical surveys and pharmacological studies. Keywords such as "*Psidium guajava*," "medicinal uses," "bioactive compounds" and "potent scavenging bioactive compounds" were employed to identify relevant publications. The field survey was conducted during February-April 2026. Plant identification was carried out with reference to the flora guide of Saxena and Brahmam (1995). Experimental analysis was performed to evaluate the antioxidant potential of *P. guajava* fruits through DPPH radical scavenging assay.

Antioxidant DPPH assay

P. guajava fruits were collected from CDA, Cuttack District of Odisha, India. The fruits were thoroughly washed, cut and macerated with different solvents like n-hexane, ethanol and distilled water separately (Figures 1 & 2). The DPPH radical scavenging assay was used to evaluate the filtered extract following Dehar et al., (2026) with minor modifications. 1 ml of 0.1 mM DPPH solution prepared in methanol was added to prepared concentrations of aqueous, ethanolic and n-hexane extracts (1.0, 0.5, 0.25 and 0.125 mg/mL) using the respective solvents adjusting the final volume to 2 ml. 1 mL 0.1 mM DPPH in 1 mL methanol was used as control. Sample blanks (without DPPH) were used for background correction of absorbance. Reaction mixtures were exposed to dark incubation at room temperature for 20 minutes and the absorbance was spectrophotometrically taken at 517 nm. Percentage of radical scavenging activity was calculated using the following formula (Table 1).

$$\% \text{ Inhibition} = A_0 - A_s / A_0 \times 100$$

Where, A_0 is the absorbance of the control and A_s is the absorbance of the sample after blank correction.



Figure 2: Collected *P. guajava* fruit for experimental analysis

Results and discussion

The present analysis evaluated the antioxidant activity of *P. guajava* fruit extracts using the DPPH radical scavenging assay across three different solvent systems, with concentrations ranging from 0.125 to 1.0 mg/ml. Among the extracts current analysis tested, the ethanolic fraction stood out with the highest scavenging activity, showing inhibition values between 82.36% and 95.69%. This strong dose-dependent response is likely due to ethanol's ability to effectively extract polar phenolics and flavonoids. The aqueous extract demonstrated moderate activity, with inhibition values ranging from 58.70% to 67.09%, highlighting the role of water-soluble antioxidants like ascorbic acid and hydrophilic tannins. In contrast, the n-hexane extract had the lowest inhibition, between 46.45% and 58.27%, which aligns with its mainly lipophilic nature. Overall, the antioxidant activity ranked as follows: ethanolic > aqueous > n-hexane. The present investigation confirmed that the polarity of the solvent plays a crucial role in how well phytochemicals are extracted and their ability to scavenge radicals, underscoring the therapeutic and nutraceutical potential of *P. guajava* fruit (Table 1 & Figure 3).

Table 1: Antioxidant potential of *P. guajava* fruit extracts

Concentration (in mg/ml)	Inhibition (%)		
	n-Hexane	Ethanolic	Aqueous
1.0	57.84	95.69	67.09
0.5	58.27	91.61	62.15
0.25	48.81	83.22	60.21
0.125	46.45	82.36	58.70

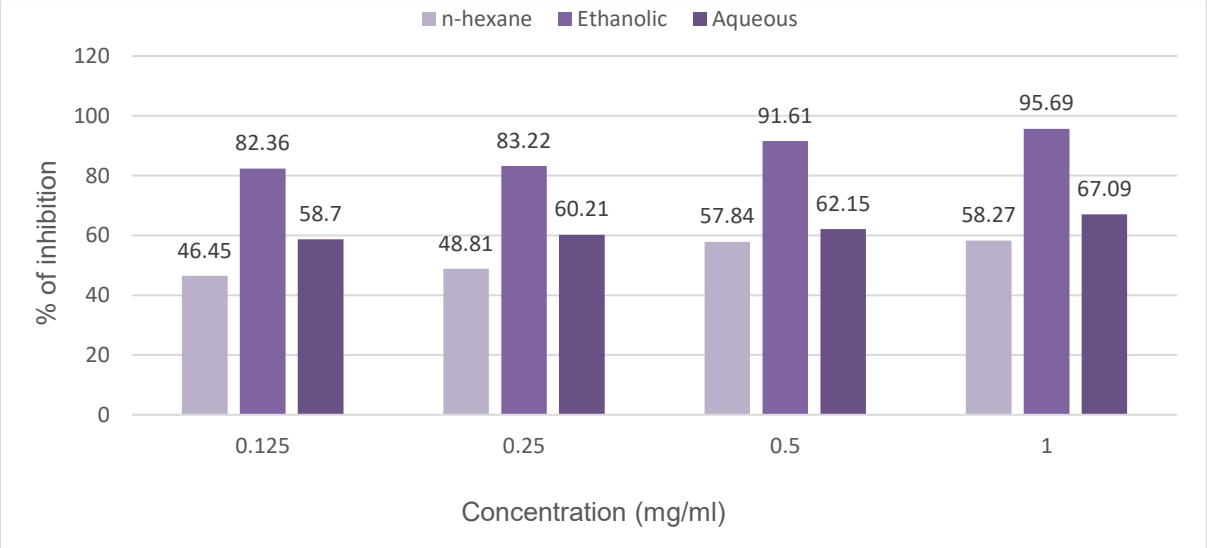


Figure 3: Antioxidant activity of *P. guajava* fruits extracts

Conclusion

Taken together, the fruit of *P. guajava* L. shows impressive antioxidant properties, with the ethanolic extract leading the pack in DPPH radical scavenging activity at an impressive 95.69%. Following closely are the aqueous and n-hexane extracts, highlighting how the polarity of the solvent plays a key role in how effectively we can extract bioactive compounds. These results underscore the potential of guava fruit in combating oxidative stress and suggest it could be a valuable addition to nutraceutical and pharmaceutical products. However, more in vivo and clinical research is needed to back up these in vitro findings and to create standardized treatment guidelines.

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