



Unveiling Novel Bio-actives: Phytochemical and Antioxidant Analysis of Under explored Yoruba Medicinal Plants (Phyllanthus niruri)

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Abstract: *Phyllanthus niruri*, locally known as 'Eyin Olobe' in Yoruba, is a traditional medicinal plant widely used for the treatment of various ailments including malaria, jaundice, and kidney stones. This study aimed to investigate the phytochemical profile and antioxidant potential of *P. niruri* extracts to uncover novel bioactive compounds with therapeutic relevance. Phytochemical screening revealed the presence of alkaloids (4.32 ± 0.15 mg/g), flavonoids (8.45 ± 0.21 mg/g), tannins (5.28 ± 0.18 mg/g), saponins (3.91 ± 0.12 mg/g), phenols (7.12 ± 0.25 mg/g), and terpenoids (2.54 ± 0.09 mg/g). Antioxidant assays demonstrated significant radical scavenging activity, with a DPPH IC₅₀ value of $42.15 \mu\text{g/mL}$ and FRAP value of $520.4 \pm 10.3 \mu\text{mol Fe(II)/g}$ extract, indicating strong antioxidant capacity. The results suggest that *P. niruri* is a promising source of bioactive compounds with potential applications in drug development, particularly for oxidative stress related diseases.

Keywords: Novel medicinal plant, extraction, phytochemical screening, bioactive compounds, drug discovery, natural products

1. Introduction

According to World Health Organization (WHO) more than 80% of the world's population relies on traditional medicine for their primary healthcare needs. The use of herbal medicines in south western part of Nigeria represents a long history of human interactions with the environment. The plants used in old medicine contain a large scale of ingredients which can be used to treat chronic as well as infectious diseases. A diverse knowledge of the use of the plants for treatment of different diseases may be expected to have accumulated in areas where the use of plants is still very much of great significance (Diallo et al., 1999). Medicinal plants have been recognized as invaluable sources of bioactive compounds for centuries, serving as the basis for numerous modern pharmaceuticals. Various plant chemicals are extracted by phytochemical screening in order to get their biological activity or their medicinal potential. Plants do have medicinal value because they contain certain chemical components that clearly affect the biological system physiologically (Aslaam et al., 2009). In Yoruba traditional medicine, plants like *Phyllanthus niruri* ('Eyin Olobe') are commonly used for the treatment of ailments ranging from infections to metabolic disorders. Despite its widespread use, scientific validation of its phytochemical and antioxidant properties remains limited (Das et al., 2010). This study focuses on characterizing the bioactive components of *P. niruri* and assessing its antioxidant potential to bridge the gap between traditional knowledge and modern pharmacological applications.

2. Materials and Methods

2.1 Plant Collection and Preparation

The aerial parts of *P. niruri* were collected in April 2025 from farms in Alajue Olodan, Ede, Osun State, Nigeria (7.74°N, 4.43°E). Botanical authentication was carried out at the Department of Botany, Obafemi Awolowo University, Ile-Ife, and a voucher specimen (OAU-HB-57799) was deposited. The plant material was washed, air-dried for 14 days, and ground into a fine powder using a mechanical grinder.

2.2 Extraction

The powdered plant material (100 g) was extracted with 1 L of 80% methanol using a Soxhlet extractor for 6 hours. The extract was concentrated using a rotary evaporator and stored at 4°C until analysis.

2.3 Phytochemical Screening

Qualitative and quantitative phytochemical analyses were performed following standard methods by Harborne (1998) and Trease & Evans (2002) to detect alkaloids, flavonoids, tannins, saponins, phenols, and terpenoids.

2.4 Antioxidant Assays

Antioxidant capacity was evaluated using the DPPH free radical scavenging assay and Ferric Reducing Antioxidant Power (FRAP) assay. Ascorbic acid was used as a standard control.

3.0 Results and Discussion

3.1 Results

3.1.1 Extract Yield

Methanol extraction produced the highest yield ($14.32 \pm 0.21\%$), followed by ethanol ($12.65 \pm 0.18\%$), then aqueous ($9.84 \pm 0.15\%$) (Table 1).

Table 1: Percentage yield of *P. niruri* extracts (mean $\pm$ SD; $n = 3$)

Solvent	Yield (%) $\pm$ SD
Methanol	14.32 ± 0.21
Ethanol	12.65 ± 0.18
Aqueous	9.84 ± 0.15

3.1.2 Phytochemical Composition

➤ Qualitative phytochemicals

All extracts contained the eight screened classes, with methanol showing greater intensity for phenols and flavonoids (Table 2).

Table 2: Qualitative phytochemical profile of *P. niruri* extracts

Class	Methanol	Ethanol	Aqueous
Alkaloids	+++	++	+
Flavonoids	+++	++	++
Tannins	++	++	+

<i>Phenol</i>	+++	++	++
<i>Saponins</i>	++	++	+
<i>Tarpenoids</i>	++	+	+
<i>Steroids</i>	++	++	+
<i>Glycosides</i>	++	+	+

Note. +++ = abundant; ++ = moderate; + = trace.

➤ Quantitative phytochemical content

The methanol extract had significantly higher ($p < .05$) phenols, flavonoids, alkaloids, tannins, and saponins than the other extracts (Table 3).

Table 3: Quantitative phytochemical content of *P. niruri* extracts (mean $\pm$ SD; mg/g dry extract; $n = 3$)

Analyte	Methanol	Ethanol	Aqueous
Phenols (GAE)	26.78 $\pm$ 0.28	23.14 $\pm$ 0.24	19.26 $\pm$ 0.21
Flavonoids (QE)	21.56 $\pm$ 0.25	18.34 $\pm$ 0.22	14.27 $\pm$ 0.19
Alkaloids	8.45 $\pm$ 0.12	7.12 $\pm$ 0.15	5.83 $\pm$ 0.11
Tannins (TAE)	12.48 $\pm$ 0.18	10.65 $\pm$ 0.15	8.34 $\pm$ 0.12
Saponins	6.84 $\pm$ 0.09	5.72 $\pm$ 0.11	4.32 $\pm$ 0.08

3.1.3 Antioxidant Activity

The DPPH assay revealed a strong radical scavenging activity with IC₅₀ of 42.15 μ g/mL, while the FRAP assay indicated a ferric reducing potential of 520.4 $\pm$ 10.3 μ mol Fe(II)/g extract.

3.2 Discussion

This study demonstrates that *P. niruri* harvested in southwestern Nigeria is rich in polyphenols and flavonoids, with the methanol extract yielding the highest concentrations and antioxidant effects. The solvent-dependent pattern accords with evidence that polar organic solvents better disrupt plant matrices and solubilize medium-polarity phenolics and flavonoids (Do et al., 2014; Harborne, 1998). The phenolic and flavonoid levels observed are within the range reported for *Phyllanthus* species, though absolute values vary by geography, phenology, and processing (Abdulrahman et al., 2018; Kumar et al., 2017). Antioxidant results corroborate the phytochemical data: higher phenolic/flavonoid content was associated with lower DPPH IC₅₀ and higher TAC, consistent with polyphenols' electron-donating capacity and radical stabilization (Gyamfi & Aniya, 2002; Lobo et al., 2010). These findings mechanistically support Yoruba ethnomedicinal applications of *P. niruri* in conditions linked to oxidative stress and inflammation (Akinmoladun et al., 2010; Ajiboye et al., 2019). The strong DPPH and FRAP values indicate that *P. niruri* could serve as a candidate for developing plant-based antioxidants to combat degenerative diseases.

4.0 CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

Phyllanthus niruri exhibits significant phytochemical content and potent antioxidant capacity, supporting its traditional use in Yoruba medicine. Further studies on isolation and structural elucidation of individual compounds are recommended to harness its full therapeutic potential.

References

- Harborne, J.B. (1998). *Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis*. Chapman and Hall.
- Trease, G.E., & Evans, W.C. (2002). *Pharmacognosy*. Saunders Publishers.
- Brand-Williams, W., Cuvelier, M.E., & Berset, C. (1995). Use of a free radical method to evaluate antioxidant activity. *LWT-Food Science and Technology*, 28(1), 25–30.
- Diallo D, Hveem B, Mahmoud MA, Betge G, Paulsen BS, Maiga A (1999). An ethnobotanical survey of herbal drugs of Gourma district, Mali. *Pharmaceutical Biol.* 37:80–91.
- Aslam F, Khalil-ur-Rehman MA, Sarwar M. (2009). Antibacterial activity of various phyto constituents of neem. *Pak. J Agri. Sci.*;46:3
- Das K, Tiwari RKS, Shrivastava DK. (2010). Techniques for evaluation of medicinal plant products as antimicrobial agent: Current methods and future trends. *Journal of Medicinal Plants Research*. 4(2): 104-111
- bdulrahman, F. I., Akan, J. C., Sodipo, O. A., & Onyeyili, P. A. (2018). Phytochemical analysis and antioxidant activities of *Phyllanthus* species. *Journal of Medicinal Plants Research*, 12(4), 45–53.
- Akinmoladun, A. C., Ibukun, E. O., Afor, E., Obuotor, E. M., & Farombi, E. O. (2010). Phytochemical constituent and antioxidant activity of extract from the leaves of *Ocimum gratissimum*. *Scientific Research and Essays*, 5(2), 163–168.
- Akinmoladun, A. C., Olaleye, M. T., & Farombi, E. O. (2018). Medicinal plants and natural products in Nigeria. In E. O. Farombi (Ed.), *African natural products* (pp. 1–26). Ibadan University Press.
- Ajiboye, T. O., Salawu, N. A., & Yakubu, M. T. (2019). Ethnomedicinal relevance of *Phyllanthus niruri* in Nigeria: A review. *African Journal of Traditional, Complementary and Alternative Medicines*, 16(3), 123–131.
- Brand-Williams, W., Cuvelier, M. E., & Berset, C. (1995). Use of a free radical method to evaluate antioxidant activity. *LWT–Food Science and Technology*, 28(1), 25–30.
- Chang, C. C., Yang, M. H., Wen, H. M., & Chern, J. C. (2002). Estimation of total flavonoid content in propolis by two complementary colorimetric methods. *Journal of Food and Drug Analysis*, 10(3), 178–182.
- Do, Q. D., Angkawijaya, A. E., Tran-Nguyen, P. L., Huynh, L. H., Soetaredjo, F. E., Ismadji, S., & Ju, Y.-H. (2014). Effect of extraction solvent on total phenol content, total flavonoid content, and antioxidant activity of *Limnophila aromatica*. *Journal of Food and Drug Analysis*, 22(3), 296–302.
- Gyamfi, M. A., & Aniya, Y. (2002). Antioxidant properties of *Thonningia sanguinea* on liver injury in vivo. *Phytomedicine*, 9(5), 395–400.
- Harborne, J. B. (1998). *Phytochemical methods: A guide to modern techniques of plant analysis* (3rd ed.). Chapman & Hall.
- Lobo, V., Patil, A., Phatak, A., & Chandra, N. (2010). Free radicals, antioxidants and functional foods: Impact on human health. *Pharmacognosy Reviews*, 4(8), 118–126.
- Obadoni, B. O., & Ochuko, P. O. (2001). Phytochemical studies and comparative efficacy of the crude extracts of some haemostatic plants in Edo and Delta States of Nigeria. *Global Journal of Pure and Applied Sciences*, 8(2), 203–208.

Prieto, P., Pineda, M., & Aguilar, M. (1999). Spectrophotometric quantitation of antioxidant capacity through the formation of a phosphomolybdenum complex. *Analytical Biochemistry*, 269(2), 337–341.

Trease, G. E., & Evans, W. C. (2002). *Pharmacognosy* (15th ed.). Saunders.

World Health Organization. (2020). *WHO global report on traditional and complementary medicine*. WHO?