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SHORT COMMUNICATION

Untargeted Gas Chromatography–Mass Spectrometry Analysis and Evaluation of Antimicrobial and Antioxidant Activity of *Zingiber nimmonii* (J. Graham) Dalzell Rhizome Extracts

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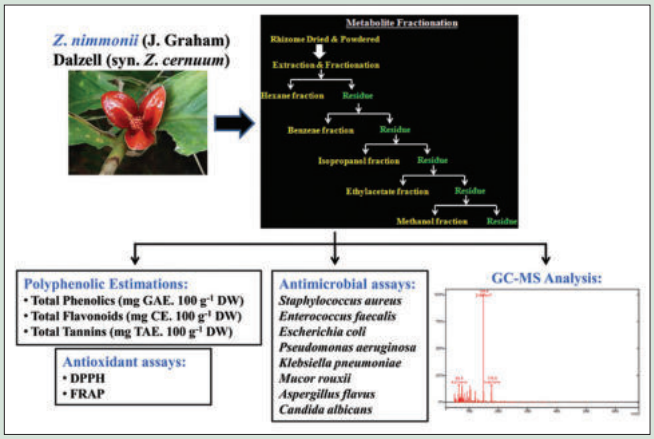
ABSTRACT

Background: *Zingiber nimmonii* (J. Graham) Dalzell (syn. *Z. cernuum*) endemic to peninsular India have been documented to be in use since ancient times in several traditional systems of medicine. *Z. nimmonii* with ethnomedicinal applications constitute a rich source of secondary metabolites toward identifying potential bioactive constituents with antioxidant and antimicrobial properties. **Objective:** Rhizomes of *Z. nimmonii* (J. Graham) Dalzell, endemic to the Western Ghats, were analyzed for bioactivity and phytochemical composition. **Materials and Methods:** Polyphenolic contents, namely total phenolics (TPs), total flavonoids (TFs) and total tannin (TT), were determined and expressed using gallic acid (GA), catechin (C) and tannic acid (TA) as standards. Antibacterial and antifungal activities were evaluated against two Gram-positive, three Gram-negative bacteria and three fungi by agar well diffusion method. Antioxidant activity was determined by 1,1-diphenyl-2-picrylhydrazyl radical (DPPH) and Ferric Reducing Antioxidant Power (FRAP) assay, and volatile metabolite composition was determined by gas chromatography–mass spectrometry (GC-MS) analysis. **Results:** THE highest TF and TT contents were detected in ethyl acetate (557.64 ± 41.74 mg CE. 100 g^{-1} DW) and isopropanol (63.995 ± 2.062 mg TA equivalent. 100 g^{-1} DW) extract, respectively. High TP content in isopropanol extract (112.80 ± 10.99 mg GA equivalent. 100 g^{-1} DW) contributed to antimicrobial activity against Gram-positive *Staphylococcus aureus* (16.3 ± 0.6 mm) and antifungal activity against *Aspergillus flavus* (11.7 ± 0.6 mm). Methanol extracts showed high antioxidant activity as determined by DPPH (67.4 ± 12.5 μg/ml) and FRAP (127.8 ± 12.4 μg/ml) assays. Major bioactive phytochemical constituents in *Z. nimmonii* rhizome following GC-MS analysis included heptanediamide, N, N′-di-benzoyloxy (arachidonic acid inhibitor), n-hexadecanoic acid (antibacterial, cytotoxic, and antioxidant), and oleic acid (antitumor). **Conclusion:** The present study demonstrates potential of *Z. nimmonii* rhizomes as a rich source of secondary metabolites which can be exploited toward developing anti-infective formulations and free radical quenchers.

Key words: Antimicrobial, antioxidant, gas chromatography–mass spectrometry, polyphenolics, *Zingiber nimmonii*

SUMMARY

- Solvent extracts of *Zingiber nimmonii* (J. Graham) Dalzell obtained following sequential extraction subjected to determination of antimicrobial and antioxidant activity
- Isopropanol extract that yielded the highest total phenolic (TP) content (112.80 ± 10.99 mg gallic acid equivalent. 100 g^{-1} DW) also showed the highest antimicrobial activity against Gram-positive *Staphylococcus aureus* (16.3 ± 0.6 mm) and highest antifungal activity against *Aspergillus flavus* (11.7 ± 0.6 mm)
- Methanol extract of *Z. nimmonii* rhizomes exhibited high antioxidant activities determined by 1,1-diphenyl-2-picrylhydrazyl radical assay as 67.4 ± 12.5 μg/ml and following FRAP assay as 127.8 ± 12.4 μg/ml
- Major bioactive metabolites identified by gas chromatography–mass spectrometry analysis included arachidonic acid inhibitor, namely heptanediamide, N, N′-di-benzoyloxy; antibacterial, cytotoxic, and antioxidant, namely n-hexadecanoic acid; and antitumor, namely oleic acid.



Abbreviations Used: GC-MS: Gas Chromatography- Mass Spectrometry, DPPH:1,1- diphenyl-2-picrylhydrazyl radical, FRAP: Ferric Reducing Antioxidant Power.

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INTRODUCTION

Genus *Zingiber* distributed throughout tropical Asia[1] comprises rhizomatous plants known for their aromatic constituents and extensive ethnomedicinal applications. The rich repertoire of secondary metabolites of *Zingiber* species constitutes potential source for identifying bioactive constituents with antioxidant and antimicrobial properties toward developing anti-infective formulations.[2] Among wild *Zingiber* taxa, *Z. nimmonii* (J. Graham) Dalzell (syn. *Z. cernuum*) is endemic to the Western Ghats, a biodiversity hotspot in the southern part of Indian peninsula.[3] *Z. nimmonii* is a perennial herb with aromatic, fleshy rhizome that is purplish-lilac inside. Besides propagating vegetatively

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