

Anti-glycemic activity of ethanolic extract and essential oils obtained by solvent-free microwave extraction and hydro-distillation of rhizomes and leaves of *Alpinia calcarata* Roscoe

N. M. T. Aazif^{1,2}, J. K. R. R. Samarasekera², G. D. Liyanaarachchi², N. Fernando¹

¹Institute of Biochemistry, Molecular Biology and Biotechnology, University of Colombo, Sri Lanka

²The Herbal Technology Section, Industrial Technology Institute, Colombo 07, Sri Lanka

Alpinia calcarata Roscoe is a rhizomatous herb used in Ayurveda and traditional Sri Lankan indigenous medicine for treatment of metabolic disorders, including diabetes. Although its anti-diabetic properties have been preliminarily investigated, comprehensive studies evaluating the glycemic regulatory properties of both rhizomes and leaves have not been reported. This study evaluated the anti-glycemic activity of rhizomes and leaves of *A. calcarata* ethanolic extracts (EE) and essential oils (EOs) obtained by hydro-distillation (HD), and Solvent-Free Microwave Extraction (SFME). HD was performed with a Clevenger apparatus, while SFME used a NEOS GR microwave extractor to obtain EOs. EEs of rhizomes and leaves were obtained following standard protocols. Anti-glycemic activity of EOs and EEs were assessed through α -glucosidase and α -amylase inhibition, and an advanced glycation end-product (AGE) formation assay with acarbose as the positive control. The leaf EE exhibited the highest α -glucosidase inhibitory activity ($IC_{50} = 7.05 \pm 0.37 \mu\text{g/mL}$), followed by the rhizome EE ($IC_{50} = 23.79 \pm 0.56 \mu\text{g/mL}$) and both were more active than the standard drug acarbose ($IC_{50} = 430.55 \pm 0.14 \mu\text{g/mL}$). α -amylase inhibitory activity of the rhizome EE was notably higher $IC_{50} = 5.70 \pm 0.09 \mu\text{g/mL}$ compared to acarbose ($IC_{50} = 76.28 \pm 0.25 \mu\text{g/mL}$). In contrast, the EOs extracted by HD and SFME showed weak inhibition in both enzyme assays, with inhibition values below 10% at 500 $\mu\text{g/mL}$. However, in the anti-AGE formation assay, EOs from leaf HD (13.08 mg RE/g) and leaf SFME (10.17 mg RE/g) showed higher inhibition compared to leaf EE (4.5 mg RE/g) and rhizome EE (3.42 mg RE/g). The EEs of *A. calcarata* rhizomes and leaves are rich in bioactive compounds and indicate strong anti-hyperglycemic effects. Additionally, the moderate anti-AGE activity observed in the EOs may further enhance therapeutic potential of this plant. Overall, these results highlight *A. calcarata* as a promising candidate for studies to identify phytochemicals, isolation and characterization of bioactive constituents and *in vivo* studies for development of natural anti-diabetic formulations.

Keywords: *Alpinia calcarata*, Antiglycemic, Inhibition, Essential oils, Ethanolic extracts

Acknowledgements: Financial assistance by Treasury grant Nos TG 21/203 and TG 23/229.