

A Combined *In-vitro* and *In-vivo* Evaluation of the Potential of *Garcinia cambogia* Supplementation in the Prevention and Management of Urolithiasis

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Urolithiasis is a recurrent global health problem with limited safe preventive interventions. Conventional therapies such as lithotripsy and surgery target treatment but not recurrence, emphasizing the need for preventive strategies. This study evaluated the anti-urolithiatic and litholytic potential of a *Garcinia cambogia*-based supplementation developed using garcinia rind powder, natural annona powder, and sucralose. A three-phase approach was adopted; (i) morpho-constitutional analysis of urinary stones using FTIR and microscopy (n=17), (ii) formulation standardization and phytochemical characterization, and (iii) a randomized, placebo-controlled clinical trial (n=20; healthy adults). Stone analysis revealed calcium oxalate as the predominant type (91%). The standardized formulation contained 6.15% protein, 8.74% crude fiber, 3.45% ash, and key minerals (Mg 76 mg/100 g, P 100 mg/100 g, K 238 mg/100 g). *In-vitro* assays showed significant inhibition of calcium oxalate nucleation ($47.2 \pm 2.1\%$) and aggregation ($39.5 \pm 1.8\%$), with dissolution rates comparable to the positive control (Cystone®). In the clinical trial, garcinia supplementation demonstrated no adverse effects on serum calcium (p=0.64), uric acid (p=0.74), or creatinine (p=0.64), confirming safety. Anthropometric measures (weight, BMI, WC) remained stable (p>0.05). However, significant reduction was observed in urinary oxalate/creatinine ratio between baseline and endpoint in the intervention group (1.34 ± 0.16 to 0.92 ± 0.28 mg/dL; p=0.03), while control values remained significantly unchanged. White blood cell counts in urine also declined, suggesting reduced urinary tract inflammation. As a whole, garcinia supplementation showed promising anti-urolithiatic potential mainly through lowering urinary oxalate excretion, with supportive *in-vitro* litholytic activity. Although limited by short duration (16 days) and small sample size, these findings provide the first *in-vivo* clinical evidence for *Garcinia cambogia* as a preventive dietary intervention for urinary stone risk. Validation of these outcomes will require extended trials with more participants and the inclusion of imaging-based evaluations.

Keywords: *Garcinia cambogia*, Urolithiasis, Hydroxycitric acid, Anti-urolithiatic, Oxalate

Acknowledgement: Wedagedara Producers (Pvt) Ltd, Bujjomuwa, Alawwa, Sri Lanka.

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