Development and Translational Evaluation of a *Garcinia cambogia*–based Nutraceutical for Urolithiasis Prevention

D.D.H.C. Thilakasiri[1], G.M. Somaratne[1]*, A.G.K. Chamodini[1], A. Chandrasekara[2], A. Bandara[3], A.G.K.C. Didulanga[4], M.A.J.N. Wijayarathna[5]

[1]*Department of Food Science and Technology, Faculty of Agriculture, University of Peradeniya, Peradeniya, 20400, Sri Lanka*
[2]*Department of Nutrition and Dietetics, Wayamba University of Sri Lanka, Gonawila, NWP 60170, Sri Lanka*
[3]*Department of Chemistry, Faculty of Science, University of Peradeniya, Peradeniya, 20400, Sri Lanka*
[4]*Department of Dermatology, National Hospital, Galle, 80000, Sri Lanka*
[5]*Wedagedara Producers (Pvt) Ltd, Bujjomuwa, Alawwa, 60280, Sri Lanka*
**gsomaratne@agri.pdn.ac.lk*

Urolithiasis is a common and recurrent medical condition worldwide, with calcium oxalate stones accounting for nearly 80% of cases. Current preventive strategies remain limited, emphasizing the need for safe, effective, and accessible nutraceutical interventions. *Garcinia cambogia*, a tropical fruit rich in hydroxycitric acid (HCA), has shown promising anti-urolithiatic properties through crystal inhibition and chelation mechanisms in experimental studies. This study aimed to develop and evaluate a standardized *Garcinia cambogia*–based nutraceutical using a translational research approach integrating *in-vitro* and *in-vivo* investigations to assess its efficacy and safety in reducing urinary lithogenic risk. A multi-phase study design was employed, comprising urinary stone characterization (n=17) using Fourier-transform infrared spectroscopy (FTIR) and microscopic analysis, formulation and standardization of a Garcinia-based supplement within safe HCA limits, *in-vitro* anti-urolithiatic assays, and a randomized placebo-controlled pilot clinical trial among healthy adults (n = 20) over 16 days. *In-vitro* assays demonstrated marked inhibition of calcium oxalate crystal nucleation (99.7±0.28%) and aggregation (65.2±4.4%), together with notable litholytic activity comparable to standard therapeutic agents. Clinical evaluation revealed no statistically significant changes in serum biochemical parameters, including calcium, uric acid, creatinine, and estimated glomerular filtration rate, indicating good short-term tolerability. Notably, a significant reduction in urinary oxalate concentration was observed within the intervention group (1.34±0.16 to 0.92± 0.28 mg/dL; $p < 0.05$), whereas no significant change was detected in the placebo group. This unexpected trend may reflect previously unrecognized interactions between HCA and urinary lithogenic pathways; however, the underlying mechanisms remain unclear and require further investigation. Additionally, a reduction in urinary white blood cell counts suggested a possible down-regulation of subclinical urinary inflammation. Given the limited sample size and short intervention duration, these preliminary clinical findings must be interpreted with caution. Overall, while the strong *in-vitro* data demonstrate robust anti-urolithiatic activity, these pilot clinical observations provide early translational evidence supporting the potential of *Garcinia cambogia*–based supplementation for urolithiasis prevention, warranting further rigorous evaluation in larger populations to confirm efficacy and clarify the underlying metabolic mechanisms.

Keywords: *garcinia cambogia*, urolithiasis, hydroxycitric acid, nutraceutical, anti-urolithiatic activity