# Anti-osteoporosis properties of xanthones from *Garcinia* plants

**Ut Dong Thach[1*], Ngoc Nhu Hao Nguyen[1], Dinh Hiep Nguyen[1], Phuoc Dien Pham[1], Tran Van Anh Nguyen[1], Truong Huy Nguyen[1], Chau Phi Dinh[1], Trinh Ngoc Ai[2], and Thanh Thuy To[3*]**

[1] *Faculty of Pharmacy, Ton Duc Thang University, Ho Chi Minh City, Vietnam*
[2] *Tra Vinh University, Tra Vinh, Vietnam*
[3] *Faculty of Biology, University of Science, VNU-HN, Hanoi, Vietnam*

* Corresponding author.
E-mail: thachutdong@tdtu.edu.vn; tothanhthuy@hus.edu.vn

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**Background**
Xanthones, secondary metabolites present in higher plants, fungi, and lichens, have gained attention due to their diverse range of biological and pharmacological activities. With approximately 650 known xanthones identified from natural sources, they exhibit antibacterial, antiviral, antioxidant, and anti-inflammatory properties. These compounds also show inhibitory effects on DNA polymerase, cytotoxicity against cancer cells, and potential as anticancer, antidiabetic, and anti-tumor agents. Recent studies have highlighted their role in promoting bone protection and addressing osteoporosis, making xanthones an exciting area of research with promising therapeutic potential.
**Methods**
Solvent extraction and column chromatography were employed to extract and isolate xanthones from *Garcinia* plants, specifically *Garcinia cochinchinensis*, *Garcinia vilersiana*, and *Garcinia mangostana*. The isolated compounds underwent chemical modifications via epoxidation, ozonolysis, and acetylation, and their chemical structures were elucidated using FT-IR, UV-Vis, MS, and NMR spectroscopies. Molecular docking and dynamic simulations were utilized for virtual screening of potential anti-osteoporosis molecules, followed by *in vivo* evaluation using a heat-shock-induced Rankl-overexpressing transgenic medaka fish model for osteoporosis. Fish larvae were treated with different doses of the compounds (0.5 -12 μM) for four days, surrounding the induction of osteoporosis phenotype, and subsequent assessment of bone mineralization damage levels was conducted.
**Results**
From three *Garcinia* species, four xanthone compounds were isolated, while three xanthone derivatives, including two newly synthesized compounds, were obtained through semi-synthesis. Extensive molecular docking analysis of over 400 xanthones resulted in the identification of 20 potential xanthone structures with promising biological activities. Remarkably, *in vivo* tests revealed that xanthones exhibited a significant reduction in bone damage in the fish ($p < 0.0001$) and achieving a bone protection index ($I_P$) of up to 62.9%.
**Conclusions**
The results of this study provide compelling evidence that xanthones have the potential to positively impact and preserve bone health.