Development of Functional Vietnamese Rice Paper Fortified with *Thunbergia laurifolia* and *Garcinia mangostana* Extracts for Antioxidant and Gastrointestinal Antibacterial Applications

Baramee Karee[1], Supakrit Kasemmongkollporn[1], Farida Mongkolrattanamanee[1], Amporn Petchote[1], Sukanya Panyavisitkul[1], Loeschay Luealai[1], Phiminan Laotaecharattanajinda[1], Adulsman Sukkaew[2,3], Taechat Sophanowong[4], and Suthee Junglok[1*]

[1]Betong Wiraratprasan School, 19 Ruamwit Road, Betong District, Betong District, Yala Province, Thailand
[2]Southern Border Researchers Association, Sateng Subdistrict, Mueang District, Yala Province, Thailand
[3]Faculty of Science, Technology and Agriculture, Yala Rajabhat University, Yala, Sateng Subdistrict, Mueang District, Yala Province, Thailand
[4]Princess Chulabhorn Science High School Satun, 138 Moo 12, Chalung District, Mueang Satun District, Satun Province, Thailand
[*]Corresponding Author E-mail: gaschem4159@kbyala.ac.th

ABSTRACT

This study aimed to develop a functional Vietnamese rice paper possessing antioxidant and antibacterial properties against gastrointestinal pathogens by incorporating crude aqueous extracts from *Thunbergia laurifolia* leaves and fresh *Garcinia mangostana* pericarps. Optimization of the base flour formulation revealed that a rice flour to tapioca starch ratio of 70:30 w/w yielded optimal textural profiles upon rehydration, demonstrating superior tenderness, chewiness, and elasticity. Crude extracts were prepared individually via hot-water decoction of fresh *T. laurifolia* leaves for 7 min and fresh *G. mangostana* pericarps for 5 min, and were subsequently incorporated into the flour batter at a controlled ratio to regulate tannin concentrations, thereby mitigating adverse effects on the physicochemical properties and sensory attributes, specifically astringency, of the final product. The rice paper sheets were formed via steam parboiling for 40 s and subsequently dehydrated in a hot-air oven at 55°C for 3 h to preserve the stability of heat-sensitive bioactive compounds.

Regarding antimicrobial efficacy, the agar disc diffusion method revealed that while the control rice paper exhibited no inhibitory activity, the extract-fortified formulation successfully released bioactive compounds, demonstrating significant zones of inhibition ($p < 0.05$) against *Escherichia coli* at 12.5 mm and *Salmonella* spp. at 14.2 mm. Furthermore, prominent antioxidant activity was observed, achieving a DPPH radical scavenging activity of 78.5%, which correlates with its potential to mitigate oxidative stress-induced inflammation. These findings indicate that key bioactive constituents, such as xanthones and tannins from the mangosteen pericarp, retained their stability and functional efficacy within the starch matrix. Consequently, this study demonstrates the successful development of a novel alternative functional food product with promising gastrointestinal health benefits, offering strong potential for commercialization in the modern health and wellness food industry.

Keywords: Functional food/ Vietnamese rice paper/ *Thunbergia laurifolia*/ *Garcinia mangostana*/ Antibacterial activity/ Antioxidant