SIFF 2026

Singapore International Food Forum 2026

Unlocking Flavour in Alternative Protein Products through Novel Kokumi Compounds

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Abstract

Flavour remains a major barrier to the widespread adoption of alternative protein (AP) products, as many fail to replicate the sensory complexity of conventional meat [1]. In parallel, excessive consumption of salt, sugar, and fat continues to contribute to chronic health conditions, including cardiovascular and metabolic diseases [2]. Age-related decline in taste perception further compounds these challenges, often leading to reduced appetite and poor nutritional intake, particularly among older adults [3].

Kokumi compounds present a promising strategy to enhance flavour without increasing unhealthy additives. Although tasteless, these molecules amplify key taste attributes—such as sweetness, saltiness, and umami—through activation of the calcium-sensing receptor (CaSR) [4]. While most known kokumi compounds are γ-glutamyl peptides that bind the orthosteric site of CaSR, the potential of allosteric activators remains largely unexplored [5].

In this study, we developed a cell-based CaSR activation assay to screen for novel kokumi compounds derived from Asian food sources. In parallel, structural bioinformatics approaches, including molecular docking and molecular dynamics simulations, are employed to identify non-peptide ligands targeting allosteric sites, with the aim of achieving synergistic receptor activation and enhanced flavour perception. Preliminary computational screening has already identified candidate small-molecule and peptide ligands targeting CaSR. By improving taste while reducing reliance on salt, sugar, and fat, this work seeks to support the development of healthier, more appealing, and sustainable alternative protein products.

References

[1] Wang, Y., Tuccillo, F., Lampi, A. M., Knaapila, A., Pulkkinen, M., Kariluoto, S., Coda, R., Edelmann, M., Jouppila, K., Sandell, M., Piironen, V., & Katina, K. (2022). Flavor challenges in extruded plant-based meat alternatives: A review. *Comprehensive Reviews in Food Science and Food Safety*, 21, 2898–2929. https://doi.org/10.1111/1541-4337.12964

[2] Han, F., Li, W., Duan, N., Hu, X., Yao, N., Yu, G., & Qu, J. (2025). Relationship between salt intake and cardiovascular disease. *Journal of Clinical Hypertension*, 27(6), e70078. https://doi.org/10.1111/jch.70078

[3] Jeon, S., Kim, Y., Min, S., Song, M., Son, S., & Lee, S. (2021). Taste sensitivity of elderly people is associated with quality of life and inadequate dietary intake. *Nutrients*, 13(5), 1693. https://doi.org/10.3390/nu13051693

[4] Ohsu, T., Amino, Y., Nagasaki, H., Yamanaka, T., Takeshita, S., Hatanaka, T., Maruyama, Y., Miyamura, N., & Eto, Y. (2010). Involvement of the calcium-sensing receptor in human taste perception. *Journal of Biological Chemistry*, 285(2), 1016–1022. https://doi.org/10.1074/jbc.M109.029165

[5] Wang, H., Suo, R., Liu, X., Wang, Y., Sun, J., Liu, Y., Wang, W., & Wang, J. (2022). Kokumi γ-glutamyl peptides: Some insight into their evaluation and detection, biosynthetic pathways, contribution and changes in food processing. *Food Chemistry Advances*. https://doi.org/10.1016/j.focha.2022.100061

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