

Optimising Antidiabetic Functional Food Formulation of *Moringa oleifera*, Tualang Honey and Kefir Milk Using Response Surface Methodology

Nur Alia Batrisyia Nordin^a, Nurdiana Samsulrizal^{ab*}

Structured Abstract

Background: Diet plays a crucial role in managing and preventing diabetes mellitus. A healthy diet can maintain blood sugar levels and minimise the risk of diabetes-related complications. Natural ingredients like *Moringa oleifera*, Tualang honey, and kefir milk have been reported to provide antidiabetic benefits due to their antioxidants, vitamins, and minerals. Despite the individual benefits, the synergistic biological effects of the combined ingredients remain unexplored. Therefore, this study aims to optimise the functional beverage formulation of *M. oleifera*, Tualang honey, and kefir milk (MTHK) to enhance its antidiabetic activity using response surface methodology (RSM).

Methods: The mixture ratios of the ingredients were determined using 3 factorial (3^3) Box Behken Design (BBD). The minimum and maximum weights for *M. oleifera*, Tualang honey, and kefir milk were set at 1 to 3 g, 20 to 40 g and 30 to 50 mL, respectively. The antidiabetic activity of the formulations was examined using α -glucosidase and α -amylase inhibition assays.

Results: The highest percentage inhibition for α -glucosidase and α -amylase inhibition assays were 76.69% (F3) and 73.8% (F10), respectively. The main contributing factor to the high percentage of inhibition was found to be kefir milk. RSM was used in predicting the optimum formulation in maximizing antidiabetic activity which were 1.0 g of *M.oleifera*, 39.55 g of Tualang honey and 48.83 mL of kefir milk. The closest practical formulation (1 g *M. oleifera*, 40 g Tualang honey and 40 mL kefir milk) was experimentally validated, resulting in α -glucosidase and α -amylase inhibition of 63.49% and 67.47% compared to predicted values of 77.01% and 73.80%.

Conclusion: In conclusion, the findings of this study demonstrate the potential antidiabetic properties of MTHK formulations, establishing a basis for further validation in future studies.

Keywords: *Moringa oleifera*, Tualang Honey, Kefir Milk, Response Surface Methodology, Antidiabetic

*Correspondence: nurdiana7251@uitm.edu.my

^a School of Biology, Faculty of Applied Sciences, Universiti Teknologi MARA, Shah Alam, Malaysia

^b TuAH Industrial Research Laboratory, Universiti Teknologi MARA, Shah Alam, Malaysia.