

Optimization of a Polyherbal Formulation of *Moringa oleifera*, *Ficus deltoidea*, and *Labisia pumila* for Enhanced Antioxidant Properties Using Simple Lattice Mixture Design

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Structured Abstract

Background: *Moringa oleifera* (Kelor), *Ficus deltoidea* (Mas cotek), and *Labisia pumila* (Kacip fatimah) are rich in antioxidant phytochemicals. However, whether combining these three ingredients may enhance their antioxidant potential remains unknown. Therefore, this study aims to develop an optimised polyherbal formulation from *M. oleifera*, *F. deltoidea*, and *L. pumila* (MFL) using Response Surface Methodology (RSM) integrated with a Simple Lattice Mixture Design (SLMD).

Methods: The minimum and maximum weights for independent variables included *M. oleifera* (X1; 0.3g–0.5 g), *F. deltoidea* (X2; 0.1g–0.3 g), and *L. pumila* (X3; 0.2g–0.4 g). All formulations were prepared to a total weight of 1 g, ensuring accurate and consistent proportions of each ingredient. The antioxidant activities of the MFL formulations designed by RSM-SLMD were evaluated using the Ferric Reducing Antioxidant Power (FRAP) assay to measure the ability of the samples to reduce ferric ions and the 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay to evaluate their potential to scavenge excessive free radicals by donating hydrogen atoms or electrons, indicating their effectiveness in neutralizing oxidative stress.

Results: All MFL formulations exhibited reducing power of antioxidants and scavenged excessive free radicals. Mathematical models showed the combined effect of the three independent variables on FRAP and DPPH activity. The graphical models showed the combined effect of the three independent variables on all responses. Moreover, the two-component interaction plots revealed synergistic effects, where specific pairwise ratios of the components enhanced antioxidant activity in both assays. The optimized formulation consisting of 0.4926 g of *M. oleifera*, 0.3000 g of *F. deltoidea*, and 0.2074 g of *L. pumila* effectively enhanced the inhibition of FRAP and DPPH simultaneously.

Conclusion: These findings highlight the potential of MFL as a multifunctional therapeutic blend with significantly enhanced antioxidant capabilities. This formulation may be valuable in the development of natural remedies, nutraceuticals, or preventive health products that aim to manage oxidative stress.

Keywords: Antioxidant, *Ficus deltoidea*, *Labisia pumila*, *Moringa oleifera*, Simple Lattice Mixture Design.

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