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PHYTOCHEMICAL SCREENING AND *IN-VITRO* ANTIDIABETIC EVALUATION OF MELINJO (*Gnetum gnemon* L.) SEED EXTRACT IN DIFFERENT MATURITY STAGES

ABSTRACT

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Melinjo (*Gnetum gnemon* L.) seeds are known to contain bioactive compounds such as phenolics, flavonoids, and stilbenoids, including resveratrol, which exhibit potential antioxidant and antidiabetic properties. This study aimed to evaluate the phytochemical profile, resveratrol content, and *in-vitro* antidiabetic activity of melinjo seed extracts at different maturity stages (green, yellow, and red), to optimize ultrasound-assisted extraction (UAE) conditions using response surface methodology (RSM). Qualitative phytochemical screening confirmed the presence of tannins, saponins, and terpenoids in all maturity stages, while alkaloids were not detected. Quantitative analysis showed that the green maturity stage exhibited the highest total phenolic content (66.14 mg GAE/g fresh sample, db), total flavonoid content (49.20 mg QE/g fresh sample, db), and resveratrol concentration (0.185 RES mg/g fresh sample, db), whereas the red stage showed the lowest values. The *in-vitro* antidiabetic activity evaluated through α-amylase and α-glucosidase inhibition assays demonstrated that green melinjo seeds had the strongest inhibitory activity with IC_{50} values of 0.507 mg/mL and 0.367 mg/mL, respectively. Correlation analysis indicated strong relationships between phenolic and resveratrol

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contents and enzyme inhibitory activity. Optimization of UAE parameters using response surface methodology identified the optimal extraction conditions at 41.53% ultrasound amplitude, 34.063 min extraction time, and 42.004 °C extraction temperature, which predicted resveratrol content of 0.356 RES mg/g fresh sample (db), IC_{50} α-amylase inhibition of 0.279 mg/mL, IC_{50} α-glucosidase inhibition of 0.159 mg/mL with an overall desirability value of 0.867. Overall, the results indicate that immature melinjo seeds possess higher phytochemical content and stronger biological activity, highlighting their potential as a natural source of functional ingredients for antidiabetic applications and further research.

Keywords: *Gnetum gnemon* L, seed maturity, antidiabetic activity, ultrasound-assisted extraction