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Herbal Extracts Encapsulated Gelatin Nanoparticles as Potential Glucose-Lowering Agents

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Abstract

Leaf extracts of *Murraya koenigii* (L.) Spreng., *Coccinia grandis* (L.) Voigt and flower extracts of *Senna auriculata* (L.) Roxb. is traditionally used for the treatment of hyperglycaemia. Although the glucose-lowering activity of these plants is scientifically proven, poor pharmacokinetic properties and formulation difficulties have hindered their development as therapeutic agents. This study attempted to load *M. koenigii, C. grandis* and *S. auriculata* extracts into gelatin nanoparticles and to assess their glucose-lowering activity using a high-fat diet fed, streptozotocin-induced diabetic Wistar rat model (5-7 weeks old, n=6/group). Aqueous, ethanol, and aqueous ethanol 70% v/v extracts of *M. koenigii, C. grandis,* and *S. auriculata* prepared by ultrasonication (40 ^{0}C, 40 kHz, 30 min) were dried and loaded into gelatin nanoparticles. The optimized nanoparticles were screened *in vivo* using rats with chemically induced type 2 diabetes mellitus and oral glucose tolerance tests (OGTT, 3 g/kg) were conducted. The glucose-lowering activity was evaluated using the total area under the OGTT curve (TAUC). The most active nanoformulations were characterized by particle size, zeta potential, and Fourier-transform infrared (FTIR) spectroscopy. The optimum loading of plant extracts into gelatin nanoparticles was achieved at concentrations ranging from 30─50 mg/mL. The particle size and zeta potential values of nanoparticles exerting the highest glucose-lowering potential ranged from 467.9─519.9 nm and (–14.7)─(–34.3) mV. The entrapment of phenolic compounds in the gel matrix via physical interactions was evident in the FTIR spectra. Gelatin nanoparticles encapsulated with *M. koenigii, C. grandis, S. auriculata* aqueous extracts, and *M. koenigii* aqueous ethanol 70% v/v extract showed significant reductions of TAUC by 16.5%(p=0.002), 13.3%(p=0.005), 17.4%(p=0.002) and 19.0%(p=0.000) respectively compared to the respective non-encapsulated extracts. It can be concluded that the glucose-lowering activity of *M. koenigii, C. grandis* and *S. auriculata* aqueous extracts, and *M. koenigii* aqueous ethanol 70% v/v extract is enhanced by encapsulation into gelatin nanoparticles.

Keywords: *Coccinia Grandis*, *Diabetes Mellitus, Gelatin Nanoparticles, Murraya Koenigii*, *Senna Auriculata.*

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