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Formulation And Characterization of Polyherbal Antidiabetic Nanoemulsion

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ABSTRACT

Diabetes mellitus is a chronic metabolic disorder characterized by persistent hyperglycemia and associated long-term complications. Although synthetic antidiabetic drugs are effective, their prolonged use may lead to adverse effects, high cost, and reduced patient compliance, necessitating the development of safer and more effective alternatives. Medicinal plants with proven antidiabetic activity offer a promising approach; however, their therapeutic potential is often limited by poor solubility, low stability, and inadequate oral bioavailability. The present study aimed to formulate and characterize a polyherbal antidiabetic nanoemulsion to enhance the physicochemical properties and release profile of selected herbal extracts. Hydroalcoholic extracts of *Momordica charantia*, *Gymnema sylvestre*, *Trigonella foenum-graecum*, and *Syzygium cumini* were combined to prepare a polyherbal extract blend. Nanoemulsions were formulated using suitable oils, surfactants, and co-surfactants, selected based on solubility studies and pseudo-ternary phase diagrams. The prepared formulations were evaluated for visual appearance, droplet size, polydispersity index, zeta potential, pH, viscosity, thermodynamic stability, and in-vitro drug release behavior. The optimized formulation exhibited nanosized droplets with narrow size distribution, high negative zeta potential indicating good stability, suitable pH, and satisfactory viscosity. Thermodynamic stability studies confirmed the robustness of the nanoemulsion system. In-vitro drug release studies demonstrated a sustained and controlled release pattern, suggesting improved availability of herbal bioactive constituents. The developed polyherbal antidiabetic nanoemulsion effectively addressed the limitations of conventional herbal formulations and shows potential as a stable and efficient delivery system for diabetes management. Further in-vivo and clinical investigations are warranted to establish its therapeutic efficacy. ...

Keywords: Diabetes mellitus; Polyherbal formulation; Nanoemulsion; Antidiabetic activity; Herbal drug delivery; Droplet size; In-vitro release.

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