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Customized polymeric core-shell nanocarrier formulation mediated naringenin delivery for the treatment of diabetes-induced nephropathy in streptozotocin-induced diabetic model.

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Objectives: We report the formulation and characterization of customized core-shell polymeric nanocarrier formulation of naringenin for the treatment of diabetes-induced nephropathy in streptozotocin-induced diabetic rat model and its relative efficacy over oral naringenin as well. Our drug in question has very low aqueous solubility, hence it poses a difficulty in its systemic bioavailability and therapeutic efficacy and hence its applicability in the physiological system. Therefore, to enhance its systemic bioavailability, the customized nanocarriers were formulated and characterized.

Methods: Nanocarriers were formulated by nanoprecipitation and solvent evaporation method, characterized by Dynamic Light Scattering (DLS) for particles size, Zeta Potential (ZP), Polydispersity Index (PDI), by Transmission Electrons Microscopy (TEM), Scanning Electron Microscopy (SEM), Atomic Force Microscopy (AFM) for size, shape and surface morphology, by Fourier Transform Infra-Red (FTIR) spectroscopy, X-Ray Differaction Spectroscopy (XRD) Streptozotocin (55 mg/kg) i.p. single dose was used to induce diabetes in male Sprague Dawley (SD) rats. After six weeks, rats were treated with naringenin nanoparticles at 30 and 100 mg/kg body weight orally for two weeks. Kidney functions like glomerular filtration rate, Serum creatinine and other biomarkers like β2-microglobulin, α1-microglobulin, Interleukin-18, Microalbumin, Blood Urea Nitrogen, Serum Albumin, Serum Total proteins performed. H&E and mast cell staining was done to assess histopathological and inflammatory alterations in acute kidney damage.

Results: The formulated nanoparticles were of 150-250 nm in diameter, exhibited good polydispersity index showed quite spherical shape and smooth surface morphology, successfully encapsulated the drug and showed a sustained drug release pattern of naringenin. The formulated nanoparticles successfully ameliorated the inflammation and malfunctions in diabetic rat kidneys compared to normal control rats. Overall the naringenin loaded nanoparticle exhibited significant protection against diabetes induced nephropathy.

Conclusions: The naringenin loaded nanoformulations serves as a novel approach for the treatment of diabetes-induced abnormalities in kidney structure and function. Further studies may be warranted in this regard.