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RESEARCH

Development and Optimization of Fexofenadine-Loaded Nanostructured Lipid Carriers: A Potential Approach for Treating Rheumatoid Arthritis

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Abstract

Rheumatoid arthritis (RA) is a chronic inflammatory disease that mainly affects synovial joints, resulting in damage to bone and cartilage. Fexofenadine, a third-generation antihistamine, is used to alleviate allergy symptoms and is known to influence the Tissue Necrosis Factor receptor signaling pathway significantly. This study aimed to repurpose Fexofenadine-loaded nanostructured lipid carriers (FX-NLCs) as a potential treatment for RA. The FX-NLCs were prepared using the Melt-Emulsification Ultrasonication method and analyzed for particle size, shape, drug encapsulation efficiency, drug loading, polydispersity index, and zeta potential. Transmission Electron Microscopy (TEM) was used to examine the internal structure, while X-ray Diffraction (XRD) assessed whether the active compounds were crystalline or amorphous within the lipid matrix. An in vivo experiment was conducted on female Wistar rats using the Complete Freund's Adjuvant (CFA) model. The optimized FX-NLC formulation exhibited a particle size of 375.6 nm, a polydispersity index (PDI) of 0.308, a zeta potential of -25.8 mV, a drug entrapment efficiency of 83.6%, and a cumulative drug release of 84.45% over 24 h. TEM images showed spherical NLCs ranging from 100 to 200 nm, with no aggregation. XRD analysis revealed that the drug mainly existed in an amorphous form after encapsulation. The in vivo results demonstrated that the test group had improved clinical activity scores compared to the control. Overall, Fexofenadine nanostructured lipid carriers effectively targeted arthritic joints, while the standard group showed no significant changes.

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