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CATIONIC LIPID NANOCARRIERS TO INCREASE THE STABILITY AND BIOAVAILABILITY OF FLAVONOIDS

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The study explores the use of cationic lipid nanocarriers (NLCs) to enhance the delivery and efficacy of flavonoids, with an emphasis on quercetin, a polyphenolic compound known for its antitumor, anti-inflammatory, and antioxidant properties. Despite its therapeutic potential, quercetin faces limitations in clinical applications due to its low water solubility and reduced bioavailability[1,2]. To overcome these challenges, nanotechnology offers a promising approach through the development of NLCs, which can improve the solubility, stability, and bioavailability of hydrophobic compounds like quercetin. This study aimed to optimize the physicochemical properties for the preparation of NLCs (using a mixture of solid lipids, liquid lipids, and polymer). The optimal percentage of the cationic biopolymer needed to synthesize the lipid nanocarrier was determined. In the methodology, NLCs were prepared using a high-pressure and high-temperature homogenization process, resulting in a stable mixture of solid and liquid lipids, ultrapure water, and surfactants. This process was followed by preliminary stabilization with Ultra-Turrax®, ensuring a suitable pre-emulsion for active encapsulation. The characterization of the nanoparticles included measuring the hydrodynamic diameter, zeta potential, and polydispersity index, with analyses conducted over 120 days to evaluate the stability of the formulations. The results indicated that the NLCs had a particle size ranging from 130 to 200 nm, a polydispersity index of 0.2 to 0.3, and a zeta potential varying from -30 mV to +30 mV. Quercetin was successfully encapsulated, and the stability of the nanoparticles was maintained over time, demonstrating the efficiency of the methodology used. Moreover, the absence of organic solvents in the production process makes high-pressure homogenization a viable option for large-scale NLC production, with environmental and safety advantages. The results suggest that NLCs not only improved the stability and solubility of quercetin but also demonstrated potential for controlled release applications. This approach could be particularly useful in treatments that require site-specific biodistribution, enhancing therapeutic efficacy and reducing side effects. It is concluded that NLCs represent a promising technology for the delivery of flavonoids and other bioactive compounds, with significant potential for application in antitumor and antioxidant therapy. The success in the incorporation and stabilization of quercetin highlights the feasibility of using NLCs as an effective strategy to overcome the limitations of bioavailability and solubility of hydrophobic drugs, opening new possibilities in the field of nanomedicine.

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