THE EFFICIENCY OF ENCAPSULATION OF NUCLEIC ACIDS IN LIPID NANOPARTICLES FOR THE TREATMENT OF EYE DISEASES

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Background: Drug delivery systems have been developed to treat diseases associated with the eye. However, one of the greatest challenges is to improve routes of administration, specifically the periocular and intravitreal, have the blood-retinal barrier as the greatest impediment. Lipid nanoparticles as a nucleic acid delivery system have been used as an alternative to treat ocular diseases, since they can cross the ocular barrier and efficiently transfecting nucleic acids to various cells of the eye. The size influences the transfection of genes, biological distribution, diffusion, and cellular uptake, so there are several factors that influence the characterization of the desired size for the nanoparticle. Several reported investigations vary in particle size and encapsulation efficiency, and a relationship between these variables has not been reported so far. Therefore, we propose the research question: What size of lipid nanoparticles targeting eye diseases has a higher encapsulation efficiency depending on the type of encapsulated nucleic acid? Methods: We used a search strategy to compare studies of nanomedicine systems aimed at eye diseases where the size of the nanoparticles and the efficiency of encapsulation of genetic material are reported based on the criteria of Preferred Reporting Items for Systematic Reviews (PRISMA ScR 2020 guidelines). Results: Out of the initial 5932, 169 studies met the inclusion criteria and were included to form the basis of the analysis. Nanoparticles reported are composed mainly of PEG-modified lipids, cholesterol and cationic lipids, that in combination with messenger or interference RNA, allows the formulation of a nanoparticle with an encapsulation efficiency greater than 95%. The diseases treated mainly focus on conditions related to the retina and cornea. Certain characteristics of nanoparticles increase encapsulation efficiency, such as the size of the nanoparticle and the charge of the outer layer of the nanoparticle, so it is essential to determine and further study the optimal characteristics to achieve an effective treatment. Although nucleic acid-loaded lipid nanoparticles are a promising treatment alternative, it still has some limitations.

Keywords: Nanomedicine, Lipid nanoparticles, Encapsulation Efficiency

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