New Frontiers in Therapy: Liposomes as a Tool for Safer and More Precise Medicine

Clara Fernandez, Bruna (School: Instituto Público Moianés)

The widespread use of drugs, together with their limited specificity and poor biodistribution, poses significant challenges. Antibiotic resistance, aggravated by decades of uncontrolled consumption, has favored the emergence of resistant bacterial strains. Another example is cannabidiol (CBD), with therapeutic potential in central nervous system disorders, but with limited access through the blood-brain barrier (BBB). Liposomes, nanoscale lipid vesicles, are emerging as a promising strategy to improve the specificity, efficacy and cellular access of drugs. This study explores whether liposomes can improve the performance of certain drugs, in particular antibiotics and CBD. The main objective was to design a chemically stable liposome capable of encapsulating drugs, evaluate its efficiency and define its physicochemical properties. Two experimental phases were performed: liposome synthesis and characterization at the University of Barcelona (UB), followed by in vitro bacterial assays at the Autonomous University of Barcelona (UAB). Results confirmed that it is possible to produce nanoscale liposomes that improve drug solubility and stability. Encapsulated antibiotics showed significantly enhanced efficacy compared to conventional delivery methods, and differences in effectiveness were observed depending on the antibiotic and bacterial strain, though variability and limited replicates prevented definitive conclusions. Despite these limitations, the initial hypotheses were largely supported. Future studies should increase replication and controls, as liposomes hold great promise for enhancing the solubility, stability, and targeting of various therapeutic agents.

Awards Won: