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The amphiphilic alkyl ester derivatives of L-ascorbic acid induce reorganization of phospholipid vesicles

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Abstract:

L-ascorbic acid alkyl esters (ASCn) are lipophilic forms of vitamin C, which maintain some of its antioxidant power. Those properties make this drug family attractive to be used in pharmacological preparations protecting other redox-sensible drugs or designed to reduce possible toxic oxidative processes. In this work, we tested the ability of L-ascorbic acid alkyl esters (ASCn) to modulate the structure, permeability and rheological properties of phospholipid bilayers. The ASCn studied here (ASC16, ASC14 and ASC12) alter the structural integrity as well as the rheological properties of phospholipid membranes without showing any evident detergent activity. ASC14 appeared as the most efficient drug in destabilize the membrane structure of nano- and micro-size phospholipid liposomes inducing vesicle content leakage and shape elongation on giant unilamellar vesicles. It also was the most potent enhancer of membrane microviscosity and surface water structuring. Only ASC16 induced the formation of drug-enriched condensed domains after its incorporation into the lipid bilayer, while ASC12 appeared as the less membrane-disturbing compound, likely because of its poor, and more superficial, partition into the membrane. We also found that incorporation of ASCn into the lipid bilayers enhanced the reduction of membrane components, compared with soluble Vitamin C. Our study shows that ASCn compounds, which vary in the length of the acyl chain, show different effects on phospholipid vesicles used as biomembrane models. Those variances may account for subtly differences in the effectiveness on their pharmacological applications.