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Effect of curcumin on lateral diffusion of phosphatidylcholines in saturated and unsaturated bilayers

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Abstract

© 2014 American Chemical Society. Curcumin, a dietary polyphenol, is a natural spice with preventive and therapeutic potential for neurodegenerative diseases such as Alzheimer's and Parkinson's diseases. Curcumin possesses a spectrum of antioxidant, anti-inflammatory, anticarcinogenic, and antimutagenic properties. Because of this broad spectrum of pharmacological activity, it has been suggested that, like cholesterol, curcumin exerts its effect on a rather basic biological level, such as on lipid bilayers of biomembranes. The effect of curcumin on translational mobility of lipids in biomembranes has not yet been studied. In this work, we used ^1H NMR diffusometry to explore lateral diffusion in planar-oriented bilayers of dimyristoylphosphatidylcholine (DMPC) and dioleoylphosphatidylcholine (DOPC) at curcumin concentrations of up to 40 mol % and in the temperature range of 298-333 K. The presence of curcumin at much lower concentrations (~ 7 mol %) leads to a decrease in the lateral diffusion coefficient of DOPC by a factor of 1.3 at lower temperatures and by a factor of 1.14 at higher temperatures. For DMPC, the diffusion coefficient decreases by a factor of 1.5 at lower temperatures and by a factor of 1.2 at higher temperatures. Further increasing the curcumin concentration has no effect. Comparison with cholesterol showed that curcumin and cholesterol influence lateral diffusion of lipids differently. The effect of curcumin is determined by its solubility in lipid bilayers, which is as low as 10 mol % that is much less than that of cholesterol's 66 mol %.

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