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RETINYL ESTERS AND CHOLECALCIFEROL INTERACT FOR THEIR INCORPORATION INTO MIXED MICELLES

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Vitamin A is essential for vision, reproduction, development and maintenance of differentiated tissues. It is present in the diet mainly as retinyl esters (RE; preformed vitamin A). Vitamin D is essential for bone health and for regulation of blood calcium and phosphate concentration. Cholecalciferol (vitamin D₃) is the main dietary source of vitamin D. RE and cholecalciferol are found together in significant amounts in numerous food items of animal origin such as milk and dairy products, liver, fatty fish or cod liver oil. To be absorbed by the small intestine following digestion, these fat-soluble molecules must be incorporated into mixed micelles. The aim of this study was to characterise the interactions between the micelles components, cholecalciferol and three RE, namely retinyl acetate, propionate, and palmitate, which could affect their absorption efficiency.

Using synthetic mixed micelles (monoolein/oleic acid/phosphatidylcholine (PC)/lysoPC/cholesterol/taurocholic acid; 0.3/0.5/0.04/0.16/0.1/5 mM), we observed marked differences in incorporation efficiencies when cholecalciferol and RE were added separately (cholecalciferol>RE). When cholecalciferol was co-incorporated with RE, its incorporation efficiency was decreased. Surface tension and dynamic light scattering measurements allowed characterization of the micelles in the absence and presence of the vitamins. The interactions between the various components were analysed by surface pressure in dynamic conditions of compression. The vitamins affected the architecture of the micelles, as inferred from the values of surface compressional moduli and excess free energies of mixing.

Together, these results show that (i) the higher solubilisation efficiency of vitamin D₃ in mixed micelles, compared to the three RE, results from its better mixing properties with the micelle components, and (ii) the decrease in the solubilisation efficiency of vitamin D₃ in the presence of a RE is correlated to the sign and value of their excess free energies of mixing.