Grazing-incidence x-ray diffraction studies on the effect of plant sterols on sphingomyelin model membranes

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Differences in the effect of two major plant sterols, namely β-sitosterol and stigmasterol, on model membranes are very controversial. Despite intensive investigations [1-3] it is still unclear, which of these phytosterols is of stronger influence on lipid model systems. Our previous Langmuir monolayer experiments on the effect of both these sterols on sphingomyelin and DPPC films [4] suggested only slightly stronger interactions of β-sitosterol, as compared to stigmasterol, with DPPC and sphingomyelin. Also, the ordering potency of the former phytosterols was found to be only slightly higher than that of stigmasterol. Since the differences in the influence of the foregoing phytosterols on the investigated lipids systems were very low, we have continued the experiments with a Grazing Incidence X-Ray Diffraction (GIXD) technique. We have applied this modern experimental method to study molecular organization of one-component lipids films (β-sitosterol, stigmasterol and sphingomyelin monolayers) and mixed phytosterol/sphingomyelin monolayers of various composition. The analysis of the obtained results proved the condensation of sphingomyelin monolayer in the presence of both phytosterols and their ordering effect induced on sphingomyelin alkyl tails. Moreover, the existence of strong interactions between monolayer components was found. However, the results obtained for both investigated sterols were, within the error range, comparable. Therefore, it seems that the ordering and condensing properties as well as the influence of of β-sitosterol and stigmasterol on sphingomyelin model membrane are quite similar.