Diosgenin-Induced Physicochemical Effects on Phospholipid Bilayers in Comparison with Cholesterol

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Diosgenin (DGN), a plant sterol isolated from *Dioscorea* family, has gained pharmacological importance for its anti-cancer, anti-inflammatory and cardioprotective effects.[1] DGN has a structural similarity to cholesterol (Cho). In particular, they possess an identical tetracyclic backbone but the spiro-acetal structure of DGN is significantly different from the linear C_8 sidechain of Cho. [Figure 1]

In this study, the membrane effects of DGN was investigated and compared to Cho using membrane fluorescent probes, differential scanning calorimetry (DSC) and solid state NMR. We examined the effects of the common tetracyclic cores and the different sidechains on the physicochemical properties in phosphatidylcholine (PC) lipid bilayer membranes. DSC thermograms showed that DGN and Cho reduce membrane cooperativity of DMPC to a similar extent. On the other hand, an equimolar mixture of DGN and Cho revealed a weaker effect on the reduction of cooperativity. In ^{2}H NMR, deuterated-DGN and Cho showed similar quadrupolar coupling values in POPC bilayers. These spectra revealed that DGN is oriented parallel to the membrane normal like Cho. It was also suggested that the affinity of DGN-Cho in the membrane is stronger than that of DGN-DGN or Cho-Cho interaction. ^{31}P NMR of POPC in bilayers revealed that, unlike Cho, DGN altered the interactions of POPC headgroups at concentrations over 30 mol%. In DPH anisotropy experiments, DGN up to 30 mol% stably bound to the POPC bilayers and induced a similar ordering effect on POPC to Cho. Measurement of membrane hydration using laurdan and prodan also revealed a similar tendency for Cho and DGN. These results suggest that DGN below 30 mol% has comparable effects with Cho on basic biomembrane properties.

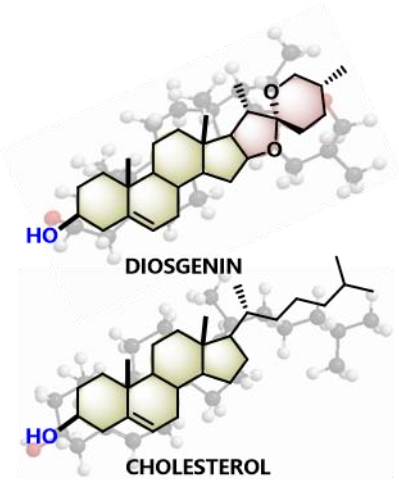

Figure 1. Chemical structures of the two sterols

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