NMR study on interaction between tea polyphenols and model lipid membranes

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Tea catechins are plant polyphenols present in the leaves of *Camellia sinensis* and are main components in green tea. Epicatechin gallate (ECg) and epigallocatechin gallate (EGCg) have various physiological effects as indicated by *in vitro* experiments, such as antioxidant activity, antihypercholesterolemia, antibacterial effect, and inactivation of influenza virus. These tea catechins are believed to contact and then interact with lipid membranes before their activities were brought out. However the dynamics of their interactions with the lipid membranes have not been clarified. The present study provides molecular-level insights into how tea catechins interact with lipid membranes.

Though this study, we used isotropic bicelles composed of a mixture of DMPC and DHPC (q = 0.5) as models of the lipid membranes. ECg/EGCg in the presence of bicelles were measured by solution NMR techniques, such as ^{1}H NMR, T_1 relaxation time, and nuclear Overhauser effect spectroscopy (NOESY).

^{1}H NMR measurements provides signals from the B ring and the galloyl moiety in ECg and EGCg that were obviously shifted and whose proton T_1 relaxation times were shortened upon interaction of the catechins with the bicelles. NOESY experiments demonstrated that the B ring and the galloyl moiety are located near the γ-H in the phospholipid trimethylammonium group (Fig. 1). On the basis of these findings, we propose that the B ring and the galloyl moiety of ECg and EGCg play an important role in this interaction. Furthermore, ECg and EGCg interact with the surface of lipid membranes via the choline moiety. The results obtained by solid-state NMR also show that ECg is located on the surface of phospholipid membranes.

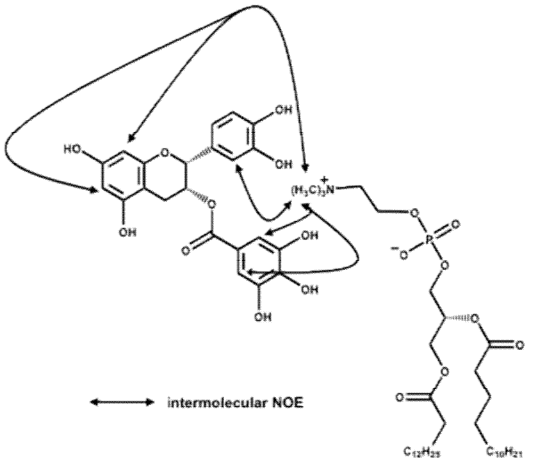

Fig. 1. ^{1}H–^{1}H NOE correlations between ECg and phospholipids obtained by NOESY experiments.

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