Interaction between tea catechins and biological components investigated by NMR spectroscopy

Yoshinori Uekusa

Department of Food and Nutritional Sciences, Graduate School of Nutritional and Environmental Sciences

Epicatechin gallate (ECg), a polyphenolic compound in green tea, has various physiological effects indicated by *in vitro* experiments. Based on the results of these experiments, ECg tends to attach externally to its targets such as lipid membranes. However, detailed structural information about ECg in lipid membranes has not yet been produced. Consequently, we investigated the dynamics and configuration of ECg that had been incorporated into bicelles and liposomes as model lipid membranes using solution and solid-state NMR techniques. Furthermore, we synthesized ^{13}C-labeled ECg (Fig. 1) in order to measure the accurate interatomic distance between ECg and phospholipids by rotational echo double resonance (REDOR) experiment.

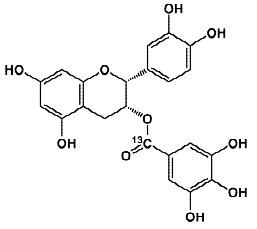

Fig. 1. ^{13}C-labeled ECg

^{1}H NMR measurement with isotropic bicelles provided that signals from the B ring and the galloyl moiety of ECg were obviously shifted, and whose proton T_1 relaxation times were shortened upon interaction of ECg with the bicelles. NOESY and observation of heteronuclear Overhauser effect demonstrated that the B ring and the galloyl moiety are located near the γ-H in the phospholipid trimethylammonium group. Solid-state ^{31}P NMR chemical shift anisotropy of the phosphate group in the liposomes' phospholipids decreased when ECg was added to liposomes. We also clarified that ECg molecules rotate about a unique axis as a main dynamics according to analysis of the powder pattern by solid-state ^{13}C NMR spectroscopy (Fig. 2). Based on these findings, it is indicated that ECg interacts with the surface of lipid membranes, and affects their fluidity and structures.

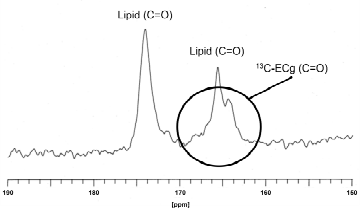

Fig. 2. Solid-state ^{13}C NMR spectrum (static)