

Chemical biology of tea catechins

Tsutomu Nakayama

*Global COE Program, Department of Food and Nutritional Sciences,
Graduate School of Nutritional and Environmental Sciences, University of Shizuoka*

Tea is the second highest drink consumed in the world, next to water. The research on tea and health has been conducted worldwide. Green tea is well known for its various physiological effects, and a number of researches have focused on tea catechins. Recently the importance of chemical biology, a domain of science of biological systems through the application of chemical techniques and tools, is recognized. In Japan recent researches on chemical biology of tea catechins have produced excellent results to clarify the interaction of these compounds with biological substances such as proteins, lipids and nucleic acids. The following are some examples of the studies proceeded in our laboratory.

Among tea catechins, (-)-epigallocatechin-3-gallate (EGCg) and (-)-epicatechin-3-gallate (ECg) has been reported to have beneficial properties including chemopreventive, anticarcinogenic and antioxidant activities. The interaction of EGCg and ECg with proteins may be related to these functions. Using chemical detection methods, it is clarified that these catechins interact with various proteins in foods and serums.

Interaction between tea catechins and phospholipids has been investigated by various methods and consistent results have been obtained. The difference in their chemical structures is correlated with their affinity for phospholipid membranes and incorporated amounts into liposomes. The equivalent results were obtained by HPLC with an immobilized artificial membrane column.

Molecular-level insights into how tea catechins interact with lipid membranes were acquired using NMR spectroscopy. Isotropic bicelles and liposomes were used as model of phospholipid membranes for solution and solid-state NMR spectroscopy, respectively. Based on these studies it is proposed that EGCg and ECg interact with the surface of lipid membranes via the choline moiety.