The Anti-allergic and Anti-inflammatory Effects of Seaweed Polyphenol (Phlorotannin)

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Summary
Algal phlorotannins are polymers consisting of phloroglucinol (1,3,5-trihydroxybenzene). Such a structure is not seen in polyphenols from terrestrial plants. Phlorotannins are abundantly present in brown seaweed. They play important roles as chemical defense components from harmful ultraviolet B rays and from being eaten by marine organisms such as abalones and sea urchins. About 10 years ago, there were only a few reports on the biochemical function of phlorotannins. Our interest was focused on the anti-allergic effects of seaweed, to investigate the biological activity of seaweeds and their components, phlorotannins. From the results of the screening tests, examining the inhibitory effects of 42 species of seaweeds on degranulation from rat basophilic leukemia (RBL)-2H3 cells, the extract of Eisenia arborea (brown seaweed) was found to have strong activity. To identify the active principles in the methanol/chloroform (MC) extract of E. arborea, the extract that showed the strong inhibitory activity against degranulation of histamine, leukotoriene B4 and prostaglandin D2 from both of RBL and/or KU812 cells, was purified by HPLC. The structural analyses on the six purified active components by mass and NMR spectra clarified that they were phlorotannins (eckol, 6,6'-bieckol, 6,8'-bieckol, 8,8'-bieckol, phlorofucofuroeckol (PFF)-A and PFF-B). One of them, PFF-B, was a novel compound. In addition to the inhibition of degranulation, these phlorotannins showed inhibition of enzyme activity (cyclooxygenase (COX)-2, lipoxygenase (LOX), phospholipase A2 (PLA2) and hyaluronidase (HA)) which are involved in the inflammatory reactions. These results implied that phlorotannins exhibit anti-allergic effects in diverse points of the inflammatory reaction system.

Recently, there also appeared papers reporting the anti-allergic and anti-inflammatory effects of phlorotannins from Ecklonia cava, Ecklonia kurome, Ecklonia stolonifera, Eisenia bicyclis and Ishige okamurae. In the present paper, these reports and our research on the anti-inflammatory phlorotannins of E. arborea were reviewed.