

Green tea and its catechins upregulate the low density lipoprotein receptor

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The low density lipoprotein (LDL) receptor is a cell surface protein which removes cholesterol carrying LDL from the circulation. Previous studies in our laboratory have found that green tea increased the expression of the LDL receptor of cultured human hepatoma (HepG2) cells. Catechins are potent antioxidants abundant in green tea. They may be the active constituents which upregulate the LDL receptor because vitamin antioxidants (A, E, C and β -carotene) have also been found to increase LDL receptor expression. The aim of this study was to determine if catechins could upregulate 1) in vitro, the LDL receptor of HepG2 cells and 2) in vivo, the hepatic LDL receptor in the rat.

HepG2 cells were incubated for 24 h with media containing either green tea extracts or pure catechins known to be present in green tea. The cells were harvested and the LDL receptor binding activity was determined by the calcium-dependent binding of colloidal gold-LDL to the intact cells. Relative amounts of LDL receptor protein were measured using an electroblot assay with a polyclonal antibody. Epigallocatechin gallate (EGCG), the most abundant catechin in tea, as well as the most potent antioxidant in green tea, significantly increased both LDL receptor activity and protein level (Figure 1) in vitro (2 and 3 fold, respectively).

To determine if the effects were evident in vivo, rats were fed a crude catechin extract from green tea for 12 days. After treatment, rat hepatic LDL receptor binding activity and protein level (Figure 2) were significantly increased (2.7 and 4 fold respectively).

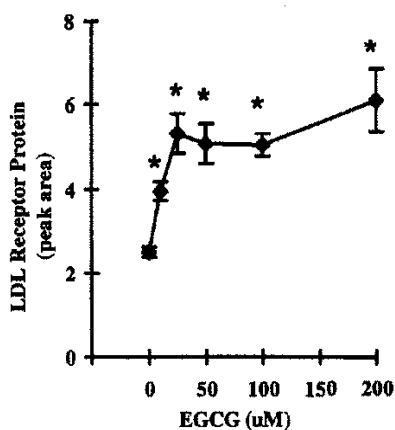


Figure 1. EGCG significantly increased LDL receptor protein level in HepG2 cells after a 24 h incubation.

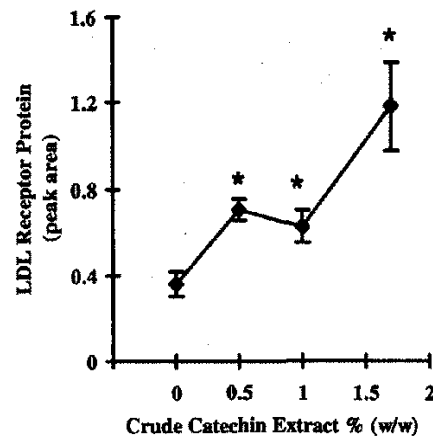


Figure 2. Crude catechin extract increased hepatic LDL receptor protein level in the rat after a 12 day feeding period.

*denotes a significant difference from control ($P < 0.05$).

These results show that catechins can upregulate the LDL receptor of HepG2 cells in vitro and that this effect on the receptor is physiologically relevant in vivo in the rat. They also suggest that EGCG is the most active constituent in green tea.