

HB-P-302

DOWNREGULATION OF THE HIGH-AFFINITY IgE RECEPTOR EXPRESSION ON MAST CELLS BY GREEN TEA CATECHIN EGCGYusuke Hasegawa¹, Yoshinori Fujimura^{1,3}, Satomi Yano¹, Koji Yamada¹, and Hirofumi Tachibana^{1,2,3,*}¹Department of Bioscience and Biotechnology, Faculty of Agriculture, ²Bio-Architecture Center, ³Innovation Center for Medical Redox Navigation, Kyushu University, 6-10-1 Hakozaki, Higashi-ku, Fukuoka 812-8581, Japan. *E-mail: tatibana@agr.kyushu-u.ac.jp; TEL&FAX: +81-92-642-3008**Summary**

Previously, we have found that a major green tea catechin, (-)-epigallocatechin-3-*O*-gallate (EGCG), suppresses the high-affinity IgE receptor (FcεRI) expression on the human basophilic cell line. Here we examine the effect of EGCG on the FcεRI expression of mouse bone marrow-derived mast cells (BMMC). Flow cytometric analysis showed that EGCG can decrease the cell surface expression of FcεRI. EGCG also suppressed the mRNA expression of FcεRI α, β, and γ subunits. Previously, we have reported that the reduction of ERK1/2 phosphorylation was involved in the downregulation of FcεRI expression. EGCG reduced the level of ERK1/2 phosphorylation in BMMC. These results suggested that EGCG have the ability to downregulate FcεRI expression of mast cells and this suppressive effect may be due to the reduction of ERK1/2 phosphorylation.

Keywords

Green tea catechin; EGCG; Allergy; BMMC; FcεRI; ERK1/2

Introduction

IgE-mediated stimulation of mast cells and basophils is an important initial event in the IgE-dependent allergic reactions. The crosslinking of allergen-specific IgE bound to the high-affinity IgE receptor FcεRI expressed on these cells with multivalent allergens results in a release of bioactive chemical mediators such as histamine, proteases, chemotactic factors and arachidonic metabolites. Therefore, FcεRI is required for mast cells and basophils to initiate the IgE-mediated allergic reaction such as atopic dermatitis, bronchial asthma, and food allergy. It is expected that the suppression of FcεRI expression in mast cells and basophils leads to the attenuation of the IgE-mediated allergic symptoms.

We have previously reported that the major green tea polyphenol, (-)-epigallocatechin-3-*O*-gallate (EGCG), has the suppressive effect of the expression of FcεRI in human basophilic cells¹. However, whether EGCG can reduce the FcεRI expression in mast cells remains unclear. In the present study, we investigated the effect of EGCG on the FcεRI expression in mast cells.

Results and discussion

To examine the effect of EGCG (Figure 1A) on the FcεRI expression of mast cells, we used the mouse bone marrow-derived mast cells (BMMC) as a mast cell model. Flow cytometric analysis showed that EGCG was able to decrease the cell-surface expression of FcεRI after a 24-h treatment in a dose-dependent manner (Figure 1B). FcεRI is a tetrameric structure comprising one α chain, one β chain, and two γ chains. The level of mRNA production of each subunit in BMMC was investigated. The mRNA expressions of all three chains in EGCG-treated BMMC were lower than non-treated cells. Previously, we have demonstrated that both the reduction of extracellular signal-regulated kinase1/2 (ERK1/2) phosphorylation and the cell-surface binding were involved in the downregulation of FcεRI expression by EGCG². As shown in Figure 1C, EGCG reduced the level of ERK1/2 phosphorylation. In addition, surface plasmon resonance assay demonstrated that the cell-surface binding of EGCG to BMMC correlated with the EGCG's ability to suppress the FcεRI expression. These results suggested that EGCG has the ability to downregulate FcεRI expression of mast cells and this suppressive effect may be due to the binding to the cell surface and subsequent reduction of ERK1/2 phosphorylation.

References

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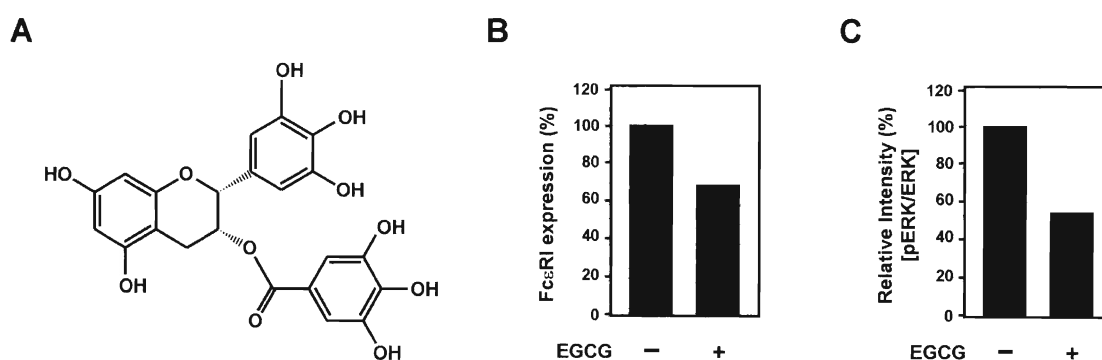


Figure 1. EGCG suppresses the FcεRI expression. (A) The chemical structure of EGCG. (B) The murine immature cultured cells BMMC were treated with EGCG. Then the cells were stained with anti-FcεRI α chain antibody CRA-1. The mean fluorescence intensity was determined using FACSsalibur. FcεRI expression (%) was represented as relative mean fluorescence intensity of EGCG(+) to EGCG (-). (C) BMMC were stimulated with EGCG, and then lysed and ERK1/2 was separated on a SDS-PAGE. Immunoblot analysis using anti-phosphorylated ERK1/2 antibody was performed.