Alteration of immune functions and Th1/Th2 cytokine balance in nicotine-induced murine macrophages: immunomodulatory role of eugenol and N-acetylcysteine.


Source

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Abstract

The aim of this study was to evaluate the immune functions by nicotine-induced murine peritoneal macrophages, and Th1/Th2 cytokine balance in it, and concurrently to establish the immunomodulatory role of eugenol, and N-acetylcysteine in nicotine-induced macrophages. Eugenol was isolated from Ocimum gratissimum, and characterized by HPLC, FTIR, and (1)H NMR. The cytotoxic effect of isolated eugenol was studied in murine peritoneal macrophages at various concentrations (0.1-50 μg/ml) using the 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide. To evaluate the immunomodulatory role of eugenol and N-acetylcysteine, ROS and nitrite generations, phenotype functions by macrophages were studied. The effect of eugenol and N-acetylcysteine on the release of Th1 cytokines (TNF-α, IL-12) and Th2 cytokines (IL-10, TGF-β) was measured by ELISA, and the expression of these cytokines at mRNA level were analyzed by real-time PCR. Eugenol, at a dose of 15 μg/ml, showed less cytotoxicity to the macrophages and it significantly reduced the nicotine-induced ROS, NO generation, and iNOSII expression. Similar kinds of response were observed in the presence of N-acetylcysteine (1 μg/ml). We have found the decreased adherence, chemotaxis, phagocytosis and intracellular killing of bacteria in nicotine treated macrophages, whereas eugenol and N-acetylcysteine with nicotine treatment enhanced these cellular functions by macrophages significantly (p < 0.05). Eugenol and N-acetylcysteine were found to down regulate the Th1 cytokines in nicotine treated macrophages with concurrent activation of Th2 responses. These findings strongly enhanced our understanding of the molecular mechanism leading to nicotine-induced suppression of immune functions, and provide additional rationale for the application of anti-inflammatory therapeutic approaches by eugenol, and N-acetylcysteine for different inflammatory diseases prevention and treatment during nicotine toxicity.