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Inhibition of MMP-9 gene expression and cancer cell proliferation by essential oils of Ocimum sanctum

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Matrix metalloproteinases (MMPs) released from inflammatory cells are involved in the development and progression of human cancers. Among the various MMPs, MMP-9 is found to be involved in metastasis of breast, colon and ovarian cancers. Natural products are effective in reducing inflammation and carcinogenesis. Essential oil from Ocimum sanctum was tested for its effect on inhibiting the proliferation of human breast cancer cells and reducing the expression of MMP-9 in human lymphocytes. Lymphocytes were treated with lipopolysaccharide to induce inflammation and then treated with essential oils. The expression of MMP-9 was analyzed using gelatin zymography and real-time reverse transcriptase PCR. Gelatin zymography showed that MMP-9 expression was completely inhibited at 250 µg/ml of essential oil. A dose dependent decrease in the expression of MMP-9 was observed in real-time RT-PCR. The inhibitory effects of essential oils on the proliferation of breast cancer cells (MCF-7) were tested using the MTT assay and real-time PCR analysis. Ocimum sanctum essential oil (OSEO) inhibited proliferation (IC50 = 170 µg/ml) and migration (IC50 = 250 µg/ml) of MCF-7 cells in a dose-dependent manner. OSEO also induced apoptosis as evidenced by the increasing number of propidium iodide stained apoptotic nuclei. Flow cytometry analysis revealed that treatment with OSEO (50–500 µg/ml) increased the apoptotic cell population dose-dependently (by 16%–84%) compared to the control. Gene expression analysis showed that OSEO up-regulated the apoptotic genes p53 and Bcl2 and elevated the ratio of Bax/Bcl-2. The results of our study indicate that OSEO has the ability to express both anti-inflammatory and anticancer activities.

Keywords: Anticancer, Essential oil, MMPs.