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Molecular mechanisms of methylsulfonylmethane and allicin in the inhibition of CD44± breast cancer cells growth

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ABSTRACT

Breast carcinoma is a common cause of cancer death in women worldwide. CD44$^+$ cells were isolated from MCF7 cell line by magnetic-activated cell sorting (MACS) and treated with methylsulfonylmethane (MSM), allicin, and the combination of them. The cytotoxicity and cell cycle arrest were measured using MTT assay and flow cytometry. Moreover, mRNA levels of apoptosis regulators *Bax*, *p53*, and *caspase-3* were measured using reverse transcriptase-polymerase chain reaction (RT-PCR). The combination treatment inhibited CD44$^-$ and CD44$^+$ cells in the G2/M and S phases of the cell cycle, respectively. Importantly, *Bax* expression was significantly higher in the MSM/allicin-treated CD44$^+$ cells than in the MSM- or allicin-treated cells ($P < .05$). The combination treatment enhanced more *caspase-3* mRNA expression than allicin alone in both CD44$^+$ cells. Taken together, the combination treatment with MSM and allicin mediated cytotoxicity through modulating the expression of the key apoptotic factors.

1. Introduction

Breast cancer is the most common cancer in women. It is one of the main causes of cancer-related mortality in less-developed regions (Ferlay et al., 2013). About 459,000 deaths were recorded worldwide during 2008 from 1.4 million women who were diagnosed with breast cancer (Youlden et al., 2012). Metastatic breast cancer cells invade bone, lung, liver, and brain, so they cause approximately 40% of the patients' relapse and ultimately die of metastasis. Therefore, surgery and radiotherapy are now considered primary treatment for early-stage breast cancers. Chemotherapy is a common treatment for metastatic breast cancer.

It has a significant impact on reducing the risk of breast cancer relapse and mortality (Weigelt, Peterse, & van't Veer, 2005). However, adjuvant chemotherapy in breast cancer causes potential long-term adverse effects, including cardiac toxicity, secondary leukemia, cognitive function, and neurotoxicity (Azim, de Azambuja, Colozza, Bines, & Piccart, 2011).

Abbreviations: RT-PCR, reverse transcriptase-polymerase chain reaction; CSCs, cancer stem cells; MTT, (3-(4,5-dimethylthiazol-2-yl)-2, 5-diphenyltetrazolium bromide); MSM, methylsulfonylmethane; MACS, magnetic-activated cell sorting.

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