

Changes in rats' breast tumor ultrastructure and immune and messenger RNA responses caused by dietary seaweed (*Kappaphycus alvarezii*) extract

ABSTRACT

The edible red seaweed *Kappaphycus alvarezii* or *Eucheuma cottonii* is commercially cultivated in the pristine tropical seas for carrageenan production. The systemic, cellular, and molecular effects of *E. cottonii* 50% alcohol extract [seaweed *E. cottonii* ethanol extract (SECE)] on breast cancer were investigated in a rat model. Mammary tumor was induced by subcutaneously injecting LA7 cells in female rat mammary pads. After 2 weeks of cancer growth, the rats received oral administration of either SECE [150 mg/kg body weight (BW) and 300 mg/kg BW] or tamoxifen. Electron microscopy imaging results confirmed macrophage activity and hematoxylin and eosin staining indicated that tumor histopathological alterations were restored toward normal structures by the seaweed extract. The extract suppressed tumor development and modulated the immune responses. This was evidenced by the microscopic observations, the increased spleen weight, size, spleen CD19 B cells, and blood immunoglobulin G (IgG) levels. The extract also increased the circulating total white blood cells, lymphocytes, segmented neutrophils count, T cells (CD3), T-helper cells (CD4), cytotoxic T cell (CD8), and nuclear factor-kappa beta expressions. The extract enhanced cancer cell death, by upregulating the Birc5, Chk1, and p53 levels and downregulating the tumor growth cellular Mdm2 (transformed mouse 3T3 cell double minute 2) messenger RNA (mRNA) expression. The extract showed no toxicity at 150 mg/kg BW in rats. The lectin-rich SECE showed tumor suppression by enhancing immune responses and upregulating the cancer cell apoptosis mRNA expressions.

Keyword: Anti-inflammatory; Breast cancer; Lectins; Macrophage; Ultrastructure