Abstract

Antiproliferative and apoptotic effects of polyphenol-rich crude methanol extract of Gracillaria edulis against human Rhabdomyosarcoma (RD) and breast adenocarcinoma (MCF-7) cell lines

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Abstract

Seaweeds are an important source of bioactive metabolites in the development of drugs and nutraceuticals. This study aimed to analyze the anti-proliferative and apoptotic activity of methanol extract (ME) of G. edulis on human Rhabdomyosarcoma (RD) and breast adenocarcinoma (MCF-7) cell lines. De-polysaccharide ME of G. edulis was extracted to determine the anti-proliferative and apoptotic activity. The cytotoxic activity was evaluated by MTT and neutral red uptake assay, while apoptotic activity was characterized by cellular morphology, DNA fragmentation and Caspase 3/7 assay. The results of cytotoxicity assay showed that the decrease of the percentage of cell viability in a dose-dependent manner as signified by cell death. The ME of G. edulis exhibited potent cytotoxicity activity against RD (IC₅₀ METHANOL: 49.86±0.02 μg/ml) and MCF-7 (IC₅₀ METHANOL: 34.43±0.86 μg/ml) cells compared to the standard cycloheximide (IC₅₀ RD: 36.17±1.78 μg/ml; IC₅₀ MCF-7: 28.76±0.55 μg/ml) as confirmed by MTT assay. Further, potential cytotoxic activity of ME (IC₅₀ RD: 33.47±2.25 μg/ml; IC₅₀ MCF-7: 35.13±0.95 μg/ml) against RD and MCF-7 were confirmed by neutral red assay compared to the standard cycloheximide (IC₅₀ RD: 32.78±0.91 μg/ml; IC₅₀ MCF-7: 27.84±0.33 μg/ml). The apoptosis was induced by activating the Caspase 3/7 pathway both in RD and MCF-7 cells treated with ME after 24 hours. Highest Caspase 3/7 activity was observed after 4 hours in RD cells, whereas in MCF-7 high Caspase activity was observed after 3 hours of the treatment. Further, the DNA ladder pattern was observed in RD cells treated with ME of G. edulis whereas MCF-7 cells did not show any typical ladder pattern. Besides, the morphological changes of apoptosis were examined using two concentrations which produce 50% cell inhibition (IC₅₀) and its half (IC₅₀/2). Most of the apoptosis morphological features were observed under the inverted microscope and when stained with fluorescence dye Hoechst stain. Thus, it can be concluded that the ME of G. edulis possesses anticancer activity via activating the Caspases pathway.

Keywords: G. edulis, Anti-cancer, Rhabdomyosarcoma, MCF-7, MTT, Neutral red.
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