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Anticancer effect of fucoidan on cell proliferation, cell cycle progression, genetic damage and apoptotic cell death in HepG2 cancer cells

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ABSTRACT

The centre of the attraction of this article is inevitably associated with fucoidan polymers in terms of brown seaweed such as *Turbinaria conoides*. Fucoidan is a sulphated polysaccharide constitutes fucose as a major principle sugar along with other monosugars such as glucuronic acid, xylose and galactose. The core value of fucoidan in terms of various cancer types were substantially exhibited through targeting the key apoptotic molecules and subsequently mitigate the toxicity that are essentially included in the chemotherapeutic agents and radiation. The pragmatic investigation about the anti-cancer effect of fucoidan in a hepatoblastoma-derived (HepG2) cell line was thoroughly analyzed by the typical techniques such as cell viability, colony formation, cell migration, cell cycle progression, genetic damage and apoptosis along with their nuclear morphology and mitochondrial membrane potential. Following the analyzes, the cell viability was precisely evaluated by 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) assay. And hence, cell cycle arrest and apoptosis was appropriately examined staining with propidium iodide (PI) and annexin V-fluorescein isothiocyante (FITC) by flowcytometer, respectively. Primarily, genetic damage by fucoidan in HepG2 cell line was evaluated by following Trevigen's comet assay kit. In addition, alteration of nuclear content and mitochondrial membrane potential were also detected with Hoechst and mitochondrial membrane potential dye (JC-1: 5,5′6,6′-tetrachloro-1,1′3,3′tetraethylbenzimi-dazolycarbocyanine iodide) by fluorescence microscopy, respectively. The results of the present study showed that cells constituted with fucoidan/quercetin standard at 50, 100 and 200 µg/ml exhibited cell viability about 71, 60 & 40/80, 65 & 45%, respectively. The above recorded effect of fucoidan was a concentration-dependant inhibition on the basis of decline in colony forming and cell migration potential of HepG2 cancer cells. Compared with untreated control, fucoidan consituted cells were significantly ($p \leq 0.05$) accumulated proliferative cells in the G_0/G_1 phase of the cell cycle in a concentration dependent manner. Increasing concentration of fucoidan (50,100 and 200 µg/ml) was remarkably enhanced the DNA damage which reflected through tail moment value of 3.8, 7.1 & 12.8 folds with respect to the untreated control. Fucoidan induced total apoptotic cells were observed ~20–40% at 50–200 µg/ml concentrations. The apoptotic cell formation effected by change in the nuclear content and mitochondrial membrane potential was confirmed in HepG2 cancer cells under fluorescence microscopy. It was eventually concluded that the fucoidan display promising anti-cancer activity against HepG2 cancer cells by promoting the inhibition of cell proliferation, migration and cell arrest on concentration dependent-manner that was well correlated with genetic damage and apoptosis.

1. Introduction

On the top of the serious array of hepatocellular carcinoma (HCC) ranks standstill among the most common cancers and causes massive death in the world population [1]. It is mainly due to lack of potential drugs as well as adverse side effects by available therapeutics. One of the new strategy to treat this deadly liver cancer [2,3] is identifying natural bioactive compounds available in the dietary supplement that rekindles the direction of research against cancer diseases [4].

Brown seaweeds are one of the major widespread groups of marine

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