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RESEARCH ARTICLE

Protective effects of fucoidan against 4-nitroquinolin-1-oxide provoked genetic damage in mouse bone marrow cells

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Abstract

Fucoidan is a unique bioactive and dietary polymer enriched mainly in the cell wall matrix of the brown seaweeds. This present study was intended to reveal the antigenotoxicity effect of fucoidan on 4-nitroquinolin-1-oxide (4-NQO) induced genetics damage and apoptosis in mice bone marrow cells. The 4-NQO caused genetic damages in the form of chromosome/chromatic breakage was estimated by micronuclei assay whereas apoptosis by annexin-V FITC kit and DNA damage by comet assay kit. In addition, oxidative damage in terms of plasma lipid peroxidation (LPO) and 8-OHdG was also estimated. In the experimental regime, six groups with each in five either sex of mice were used. Fucoidan constituted (50,100,200 mg/kg bwt) by orally for 5 days consequently and on 6th day, 4-NQO was administered (7.5 mg/kg bwt) by i.p. The results clearly show that negative control (H_2O) and fucoidan alone constituted mice were not exhibited significant effect on LPO, genetic damages whereas positive control group (4-NQO 7.5 mg/kg bwt, i.p.) showed significant effect on genetic damage by showing increased level of LPO (6.25 vs 1.3 μM MDA), 8-OHdG (12 vs 4%), micronuclei about six-fold, 5-fold of comet, and 4-fold of apoptosis when compared with negative control, 11.6 ± 2.07, 5.00 ± 1.58, and 4.14 ± 0.65 respectively. Fucoidan pretreatment significantly protected the 4-NQO-induced genetic damage by 77% decreased level of micronuclei and 96% comet at dose of 200 mg/kg bwt over the positive control whereas LPO, 8-OHdG, and apoptosis were restored as equal to negative control. This study found as fucoidan possessing significant antigenotoxicity property by protecting 4-NQO-induced genetic damage in mice bone marrow cells as dose dependent manner suggest as valuable food supplements and medicine for mankind from environmental toxicants.

Keywords Antigenotoxicity · Fucoidan · LPO · 8-OHdG · Micronuclei · Comet · 4-NQO

Introduction

Since ancient time, seaweeds have traditionally been utilized as supplement in functional foods, healthcare, and medicine from many parts of the East Asian country (Park et al. 2014; Hwang et al. 2016). Even though hydrocolloid polysaccharides such as agar, carageenan, and alginate enormously presented in most of the seaweeds, fucoidan is a unique bioactive and dietary polymer enriched mainly in the cell wall matrix of the brown seaweeds such as kombu, mozuku, mekabu, limumoui, bladderwrack, and wakame (Atashrazm et al. 2015; Kuznetsova et al. 2014), and some extend in marine invertebrates like sea urchin and sea cucumber (Kordjazi et al. 2018). In brown seaweeds, in addition to fucoidan, they are also included minerals, tannins, polyphenols, vitamins along with proteins, lipids, and carotene pigments (Eluvakkal et al. 2010; Moghadamtousi et al. 2014). Fucoidan is a sulfated polysaccharide predominantly constituted sulfated fucose along with minor components of glucuronic acid, xylose, and galactose (Ale et al. 2011; Arumugam et al. 2017) enfold with various biological activities such as anticoagulant, antiinflammatory, antiangiogenic, antiviral, antimetastatic, cytotoxicity, and antioxidants (Wang et al.

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