Prevention of Ultraviolet B-induced Lens Oxidative Damage in Mice by *Dunaliella salina*, A Carotenoids-Rich Alga

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Abstract: The present study examined the protective effects of *Dunaliella salina* (*D. salina*) on ultraviolet B (UVB) radiation-induced lens oxidative damage in male ICR mice. Lens oxidative damage was induced by exposure UVB radiation. Animal were orally administered (gavage) *D. salina* at doses of 0, 123 and 615 mg/kg body weight/day for eight days. Lens glutathione (GSH) and malondialdehyde (MDA) levels as well as the activities of superoxide dismutase (SOD), catalase and glutathione peroxidase (GSH-Px) in lens were measured to monitor lens injury. The results showed that UVB irradiation caused significant damages to lens, including decreased the activities of SOD, catalase and GSH-Px, and GSH content in lens whereas increased lens MDA content, compared with control group. Treatment with *D. salina* could significantly ($p < 0.05$) ameliorate lens oxidative damages, as evidenced by increased the activities of SOD, catalase and GSH-Px, and GSH content and decreased the MDA content in lens when compared with UVB-treated group. Those results demonstrate that *D. salina* exhibits potent protective effects on UVB radiation-induced lens oxidative damage in mice, likely due to both the increase of antioxidant enzymes activities and the inhibition of lipid peroxidation.
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1. Introduction

Ultraviolet (UV) irradiation is the most frequent cause of radiation injury to the eye, which is affected by oxidative stress due to its physical and metabolic characteristics. Particularly, the lens is most affected by oxidative damage caused by UVB radiation, because it is an avascular structure and has a constant and spare production of lenticular proteins [1]. Many studies reported that antioxidants can effectively prevent and cure UVB-induced protein oxidation and photoperoxidation of lipids in lens [2-3]. A major defense mechanism for prevention and treatment of lens oxidative damage comprises reducing the production of reactive metabolites by raising the levels of endogenous antioxidant enzymes, such as superoxide dismutase (SOD), catalase and glutathione peroxidase (GSH-Px), and decreasing lipid peroxidation [1, 4].

Dunaliella salina (*D. salina*) is a type of unicellular biflagellate green alga from Chlorophyceae gender without a rigid cell wall structure and can yield three major valuable products, glycerol, β-carotene and proteins [5-8] *D. salina* is safe and good for human health, because *D. salina* contains abundant β-carotene and other carotenoids including lutein, zeaxanthin and α-carotene [9-10]. Recently, our group demonstrated that *D. salina*, which contains abundant carotenoids and xanthophylls, is efficient antioxidants against a variety of oxidative stress *in vitro* and *in vivo* [8, 10]. It is well know that the major precursor of vitamin A is β-carotene, which quenches excited sensitizer molecules and singlet oxygen. Additionally, lutein and zeaxanthin are found in high concentrations in some ocular tissues, such as the macula, retina and lens [11-12]. Several studies have demonstrated that high dietary xanthophylls intake is associated with reduced cataract prevalence [13-14].

In consideration of excellent antioxidant activities of *D. salina*, we hypothesized that administration of *D. salina* may enhance the antioxidant defense system and thus provide against UVB-induced lens oxidative damage in mice. In the present study, male ICR mice were orally treated with *D. salina* daily accompanied by UVB exposure for a period of 8 days. Lens GSH and MDA levels, as well as SOD, catalase and GSH-Px activities in lens tissues, were also measured to monitor lens injury.

2. Material and Methods

D. salina material