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Astaxanthin, canthaxanthin and β -carotene differently affect UVA-induced oxidative damage and expression of oxidative stress-responsive enzymes

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Abstract: Carotenoids are used for systemic photoprotection in humans. Regarding mechanisms underlying photoprotective effects of carotenoids, here we compared the modulation of UVA-related injury by carotenoids. Human dermal fibroblasts (HDF) were exposed to moderate doses of UVA, which stimulated apoptosis, increased levels of reactive oxygen species and thiobarbituric acid reactive substances, decreased antioxidant enzymes activities, promoted membrane perturbation, and induced the expression of heme oxygenase-1 (HO-1). The carotenoids astaxanthin (AX), canthaxanthin (CX) and β -carotene (β C) were delivered to HDF 24 h before exposure to UVA. Astaxanthin exhibited a pronounced photoprotective effect and counteracted all of the above-mentioned UVA-induced alterations to a significant extent. β -Carotene only partially prevented the UVA-induced decline of catalase and superoxide dismutase activities, but it increased membrane damage and stimulated HO-1 expression. Moreover, β C dose-dependently induced caspase-3 activity following UVA exposure. In contrast, CX had no effect on oxidative damage, except for HO-1 expression, which was augmented. Uptake of AX by fibroblasts was higher than that of the other two carotenoids. The photostability of the three compounds in fibroblasts was AX > CX >> β C. The data indicate that the oxo-carotenoid AX has a superior preventive effect towards photo-oxidative changes in cell culture.

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