

Dietary Lutein/Zeaxanthin Partially Reduces Photoaging and Photocarcinogenesis in Chronically UVB-Irradiated Skh-1 Hairless Mice

S. Astner^a A. Wu^a J. Chen^a N. Philips^c F. Rius-Diaz^a C. Parrado^f
M.C. Mihm^b D.A. Goukassian^d M.A. Pathak^a S. González^{a, e}

^aWellman Center for Photomedicine, Department of Dermatology, and ^bDepartment of Pathology, Massachusetts General Hospital, Harvard Medical School, Boston, Mass., ^cDepartment of Biological Sciences, School of Natural Sciences, Fairleigh Dickinson University, Teaneck, N.J., ^dDepartment of Dermatology, Boston University Medical School, Boston, Mass., and ^eDermatology Service, Memorial Sloan Kettering Cancer Center, New York, N.Y., USA; ^fNormal and Pathologic Morphology, Faculty of Medicine, University of Málaga, Málaga, Spain

Key Words

Lutein · Zeaxanthin · Carotenoids · Photoaging · Photocarcinogenesis

Abstract

Lutein and zeaxanthin are xanthophyll carotenoids with potent antioxidant properties protecting the skin from acute photodamage. This study extended the investigation to chronic photodamage and photocarcinogenesis. Mice received either a lutein/zeaxanthin-supplemented diet or a standard nonsupplemented diet. Dorsal skin of female Skh-1 hairless mice was exposed to UVB radiation with a cumulative dose of 16,000 mJ/cm² for photoaging and 30,200 mJ/cm² for photocarcinogenesis. Clinical evaluations were performed weekly, and the animals were sacrificed 24 h after the last UVB exposure. For photoaging experiments, skin fold thickness, suprapapillary plate thickness, mast cell counts and dermal desmosine content were evaluated. For photocarcinogenesis, samples of tumors larger than 2 mm were analyzed for histological characterization, hyperproliferation index, tumor multiplicity, total tumor volume and tumor-free survival time. Results of the photoaging experiment revealed that skin fold thickness and number of

infiltrating mast cells following UVB irradiation were significantly less in lutein/zeaxanthin-treated mice when compared to irradiated animals fed the standard diet. The results of the photocarcinogenesis experiment were increased tumor-free survival time, reduced tumor multiplicity and total tumor volume in lutein/zeaxanthin-treated mice in comparison with control irradiated animals fed the standard diet. These data demonstrate that dietary lutein/zeaxanthin supplementation protects the skin against UVB-induced photoaging and photocarcinogenesis.

Copyright © 2007 S. Karger AG, Basel

Introduction

UVB radiation ($\lambda = 290\text{--}320$ nm) is considered the major harmful component of sunlight causing oxidative stress and manifestation of photoaging and photocarcinogenesis [1–3]. Photoaging is characterized by increased epidermal thickness, qualitative and quantitative changes in dermal collagen, dermal elastosis and dermal infiltration with mast cells [4–6]. Photocarcinogenesis, characterized by the development of skin tumors, results from irreversible genetic alterations and immunosup-