COSMECEUTICAL CRITIQUE

Zeaxanthin

BY LESLIE S. BAUMANN, M.D.

Photoprotective activity is exhibited by such plant constituents as carotenoids, tocopherols, vitamin C, and flavonoids and other polyphenols. Indeed, the health benefits of carotenoids have been at least partly attributed to their antioxidant properties, as investigators have demonstrated that carotenoids display significant scavenging capacity for singlet oxygen and other reactive oxygen species (Biochim. Biophys. Acta 2005;1740:101-7).

As dietary antioxidants, carotenoids have been shown to impart photoprotection to human skin by efficiently scavenging peroxyl radicals and suppressing lipid peroxidation (Photochem. Photobiol. 2002;75:503-6). In addition, epidemiologic studies have yielded an association between reduced risks of numerous diseases and the consumption of a carotenoid-rich diet (Biochim. Biophys. Acta 2005;1740:101-7).

Zeaxanthin is among the most studied of the carotenoids, behind beta-carotene, lycopene, and lutein, all of which constitute the primary carotenoids in human blood and tissues. A member of the xanthophyll class of carotenoids, zeaxanthin is closely related to astaxanthin and, in particular, to beta-carotene and lutein (J. Nat. Prod. 2006;69:443-9). Unlike beta-carotene, however, zeaxanthin cannot be converted into vitamin A. And like other carotenoids, zeaxanthin cannot be synthesized in the human body. Green leafy vegetables and egg yolk are particularly good sources of dietary zeaxanthin (Mol. Aspects Med. 2005;26:459-516; Nutr. Res. Rev. 2007;20:163-79).

Anticarcinogenic Action

Further support for the dietary contributions of the carotenoids, which are associated most closely with photoprotection of the eyes, comes from a prospective study of 1,001 randomly selected Australian adults. Researchers sought to identify the relationship between the consumption of antioxidant nutrients and the risk of skin cancer, specifically basal cell and squamous cell carcinomas. They recorded histologically confirmed cancers between 1996 and 2004. Antioxidant consumption estimates were made in 1996. In subjects with a baseline history of skin cancer, high consumption of lutein and zeaxanthin was linked to a lower incidence of squamous cell carcinoma (Eur. J. Cancer 2007;43:2707-16). The typical human diet includes 1-3 mg of lutein daily, with about a 5:1 ratio of lutein to zeaxanthin in the diet (Nutr. Res. Rev. 2007;20:163-79).

Zeaxanthin, along with lycopene and lutein, are known to be efficient quenchers of free radicals engendered by photo-oxidative processes and, therefore, are thought to impart protection against light-induced damage to skin, the eyes, and other light-exposed tissues (Int. J. Vitam. Nutr. Res. 2003;73:95-100). Furthermore, both lutein and zeaxanthin are coming to be considered as potent antioxidants that can protect the skin from acute photodamage (Skin Pharmacol. Physiol. 2007;20:283-91). Indeed, recent animal studies have shown that both of these xanthophylls evince efficacy against ultraviolet-induced cutaneous damage, and studies in humans have indicated the presence of these potent carotenoids in the skin (Clin. Dermatol. 2009;27:195-201).

Eye Proctection

Among the fewer than 20 carotenoids found in the human body, only lutein, its coexistent isomer zeaxanthin, and the related xanthophyll mesozeaxanthin are present in the macula lutea, where light is focused by the lens (Clin. Dermatol. 2009;27:195-201).

Several studies have indicated that they confer substantial photoprotection to the eye. Lutein and zeaxanthin are the predominant carotenoids of the retina, where they are present in high concentrations in the fovea centralis and are considered to be important in preventing age-related macular degeneration (Biochim. Biophys. Acta 2005;1740:101-7; J. Invest. Dermatol. 2003;121:399-405).

Anti-Inflammatory Effects

In 2002, Morganti et al. examined the effects of the oral ingestion of zeaxanthin and lutein on human skin. For an 8-week period, subjects daily consumed an oral antioxidant cocktail that contained 6 mg of lutein and 0.18 mg of zeaxanthin. Within the first 2 weeks, investigators noted that cutaneous lipid peroxidation had substantially declined. The significant decrease continued throughout the study. Skin moisturization also increased significantly throughout the study, with the first increases noted within 2 weeks of the beginning of the study (Int. J. Cosmet. Sci. 2002;24:331-9).

In 2003, González et al. studied the cutaneous response to a single dose of ultraviolet B (UVB) irradiation in female hairless SKH-1 mice receiving 0.4% and 0.04% lutein plus a zeaxanthin-enriched diet for 2 weeks. The investigators examined skin biopsies taken 24 and 48 hours after irradiation, and identified a dose-dependent UVB-induced inflammatory reaction. Furthermore, significant reductions in the edematous cutaneous response were seen in the mice given the 0.4% concentration of xanthophyllic carotenoids, as ascertained by a decrease in ear bifold thickening provoked by UVB exposure. The authors concluded that oral supplementation with lutein and zeaxanthin blunted the effects of UVB radiation by mitigating acute inflammatory responses and hyperproliferative markers (J. Invest. Dermatol. 2003;121:399-405).

Action Against Photoaging

In 2007, several of the same investigators studied the role of dietary lutein and zeaxanthin in the context of chronic photodamage and photocarcinogenesis. One group of female SKH-1 hairless mice was administered a diet supplemented with the two carotenoids, and another group received a standard diet. UVB radiation was directed to the dorsal skin of the mice, with cumulative doses of 16,000 mJ/cm^2 for photoaging and 30,200 mJ/cm^2 for photocarcinogenesis.

The photoaging portion of the experiment revealed that mice fed the lutein-zeaxanthin supplements exhibited significantly fewer infiltrating mast cells and thinner skin folds after UVB exposure than the control mice. Likewise, in the photocarcinogenesis experiment, the supplemented mice displayed increased tumor-free survival, lower tumor multiplicity, and smaller total tumor volume, compared with controls. The authors concluded that the skin can be protected from UVB-induced photoaging and photocarcinogenesis through lutein-zeaxanthin dietary supplementation (Skin Pharmacol. Physiol. 2007;20:283-91).

Also in 2007, Palombo et al. conducted a clinical trial in human subjects to evaluate the efficacy of lutein and zeaxanthin administered orally, topically, or via both routes. They evaluated five cutaneous parameters: skin elasticity, skin lipid peroxidation, surface lipids, hydration, and photoprotective activity. The investigators found that the combination of orally and topically administered lutein and zeaxanthin yielded the highest level of antioxidant protection, although significant protection also was afforded by oral and topical administration of the individual carotenoids (Skin Pharmacol. Physiol. 2007;20:199-210).

Conclusions

The many nutritional contributions of carotenoids have gained increasing attention in recent years, with research showing that these compounds have significant potential to impart wide-ranging salubrious effects.

For more than a decade, zeaxanthin has been known, in association with the carotenoid lutein, to confer substantial photoprotection to the eye's retina and macula lutea. Recent results suggest that the protective activity of this antioxidant extends to the skin. While the evidence is promising, much more research is necessary to determine the potential role of zeaxanthin in dermatologic products. In the meantime, carotenoids remain an important component of a healthy diet. ■

DR. BAUMANN *is director of cosmetic dermatology at the University of Miami. To respond to this column, or to suggest topics for future columns, write to Dr. Baumann at our editorial offices via e-mail at sknews@elsevier.com.*

Onion Extract With SPF 30 Reduces Scars

BY BRUCE JANCIN

SAN FRANCISCO — A cream containing an onion extract and UVA and UVB sun protection significantly improves the appearance and feel of postsurgical scars, a small randomized trial found.

Nonprescription Mederma cream plus SPF 30 performed in the study comparably to Mederma onion extract gel without SPF for reduction of postsurgical scarring. Additionally, patients rated the cream as significantly more soothing than Mederma gel, Dr. Zoe D. Draelos reported at the annual meeting of the American Academy of Dermatology.

No placebo arm was included in the comparative trial because the study aim was to establish whether parity exists between the two onion extract formulations, both marketed OTC by Merz Pharmaceuticals, which sponsored the study. The gel formulation, which doesn't include sun protection, had already demonstrated superiority to placebo in an earlier randomized trial conducted by Dr. Draelos (J. Cosmet. Dermatol. 2008;7:101-4).

The new trial involved 20 patients with symmetric seborrheic keratoses at least 8 mm in diameter located on their right and left upper chest. The lesions were removed with a scalpel shave under local anesthesia. After the wound sites were permitted to heal for 2 weeks, patients returned for randomization. Three times daily for 8 weeks, they put a thin layer of the onion extract cream on the right chest scar and a layer of gel on the left chest scar, or vice versa, explained Dr. Draelos, who practices in High Point, N.C.

Blinded investigator assessment of the scars documented by photography showed significant improvement over time on 4-point scales assessing scar redness, texture, softness, and global appearance. The degree of improvement was similar for onion extract cream– and gel-treated scars.

There was also significantly less transepidermal water loss at the onion extract cream–treated excision sites than the gel-treated sites after treatment, probably because of the moisturizing base in the cream vehicle.

The therapeutic basis for the onion extract product's efficacy is believed to lie in its anti-inflammatory effects and its inhibition of fibroblast proliferation. The SPF 30 sun protection was incorporated into the cream formulation because scars are sunlight sensitive, and once they sunburn they often darken and become cosmetically unacceptable, she explained.

Dr. Draelos disclosed that she is a consultant to Merz and has been paid to conduct research for numerous pharmaceutical companies. ■