

Identification and quantitation of carotenoids and their metabolites in the tissues of the human eye.

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There is increasing evidence that the macular pigment carotenoids, lutein and zeaxanthin, may play an important role in the prevention of age-related macular degeneration, cataract, and other blinding disorders. Although it is well known that the retina and lens are enriched in these carotenoids, relatively little is known about carotenoid levels in the uveal tract and in other ocular tissues. Also, the oxidative metabolism and physiological functions of the ocular carotenoids are not fully understood. Thus, we have set out to identify and quantify the complete spectrum of dietary carotenoids and their oxidative metabolites in a systematic manner in all tissues of the human eye in order to gain better insight into their ocular physiology. Human donor eyes were dissected, and carotenoid extracts from ocular tissues [retinal pigment epithelium/choroid (RPE/choroid), macula, peripheral retina, ciliary body, iris, lens, vitreous, cornea, and sclera] were analysed by high-performance liquid chromatography (HPLC). Carotenoids were identified and quantified by comparing their chromatographic and spectral profiles with those of authentic standards.

Nearly all ocular structures examined with the exception of vitreous, cornea, and sclera had quantifiable levels of dietary (3R,3'R,6'R)-lutein, zeaxanthin, their geometrical (E / Z) isomers, as well as their metabolites, (3R,3'S,6'R)-lutein (3'-epilutein) and 3-hydroxy-beta,epsilon-caroten-3'-one. In addition, human ciliary body revealed the presence of monohydroxycarotenoids and hydrocarbon carotenoids, while only the latter group was detected in human RPE/choroid. Uveal structures (iris, ciliary body, and RPE/choroid) account for approximately 50% of the eye's total carotenoids and approximately 30% of the lutein and zeaxanthin. In the iris, these pigments are likely to play a role in filtering out phototoxic short-wavelength visible light, while they are more likely to act as antioxidants in the ciliary body. Both mechanisms, light screening and antioxidant, may be operative in the RPE/choroid in addition to a possible function of this tissue in the transport of dihydroxycarotenoids from the circulating blood to the retina.

This report lends further support for the critical role of lutein, zeaxanthin, and other ocular carotenoids in protecting the eye from light-induced oxidative damage and aging.

CONCLUSIONS:

- Lutein, zeaxanthin and other ocular carotenoids may protect the eye from light-induced oxidative damage and aging.