

Lutein and Zeaxanthin in the Protection Against Eye Disease

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Lutein, and its isomer zeaxanthin, are non-provitamin A carotenoids found in dark green, leafy vegetables (1). The retina and lens suffer oxidative damage, and antioxidants are implicated as protective. Given that lutein and zeaxanthin are the major carotenoids found in the macula (2) and lens (3), these two carotenoids may serve a unique role in protecting against eye disease.

Lutein and zeaxanthin have been implicated as being protective against age-related macular degeneration (AMD) and cataracts (4). The observational data from epidemiologic studies showed that persons with higher serum levels of individual carotenoids, including lutein/zeaxanthin, had a statistically significant reduction in the risk of neovascular/exudative AMD (5). An analysis of dietary histories of participants in the Eye Disease Case Control Study demonstrated that persons with a higher intake of lutein had a reduced risk of AMD. Currently, there is an on-going clinical trial designed to assess the effects of oral supplementation of lutein and zeaxanthin on the progression of advanced AMD. The Age-Related Eye Disease Study 2 (AREDS2: <http://www.areds2.org>) is a placebo controlled, double blind, multi-center, randomized trial that will also assess the effects of lutein and zeaxanthin and/or long-chain omega-3 fatty acids (docosahexaenoic acid and eicosapentaenoic acid).

The Beaver Dam Eye Study, which involves adults from 43-84 years of age, suggests that lutein and zeaxanthin intake may reduce the incidence of cataracts. In a prospective study of

77,466 female nurses 45-71 years old, nurses with the highest intake of lutein and zeaxanthin had 22 percent lower risk of cataract extraction compared to those in the lowest quintile of intake. This study also showed that high intake of spinach and kale, green vegetables rich in lutein, may reduce the risk of cataract extraction (6). In a similar study, Brown and collaborators studied the association between carotenoids (alpha-carotene, beta-carotene, lutein, lycopene, beta-cryptoxanthin and lycopene) and Vitamin A intakes and cataracts extraction in 36,344 male health professionals 45 to 75 years old. Researchers found that men with the highest consumption of lutein and zeaxanthin had a 19 percent lower risk of cataract extraction compared to men with the lowest consumption. Furthermore, among foods high in carotenoids, broccoli and spinach, vegetables rich in lutein, had the strongest association with a lower risk of cataracts (7).

Lutein and zeaxanthin are thought to be protective through their ability to efficiently absorb blue light. Reducing the amount of blue light that reaches the structures of the eye that are critical to vision may protect them from light-induced oxidative damage (8). In addition to their role as blue light filters, lutein and zeaxanthin are believed to limit oxidative damage by quenching reactive oxygen species. Lutein and zeaxanthin feature a conjugated hydrocarbon chain connecting two cyclic carbon rings. Conjugated double-bond chains are effective quenchers of singlet oxygen and other reactive oxygen species. It is thought that reactions with reactive oxygen species can be the initial steps in the pathogenesis of AMD and cataracts.

Given the positive association between lutein and zeaxanthin and AMD and cataracts, inclusion of these compounds to the daily diet may be warranted. There is no established DRI for lutein or zeaxanthin. However, 6 mg is associated with a reduced risk of cataracts and age-related macular degeneration (AMD) (7, 9, 10). Most Americans only get 1-2 mg/day (11-14)

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