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Nutraceutical UPDATE

Targeted Protection for the Eyes

with Ancillary Benefit to the Skin and Arteries

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Of the five human senses, vision is perhaps the most precious of all, as it allows us to see and navigate the world around us. With each passing year, however, adults become more likely to develop vision-robbing conditions such as macular degeneration and cataracts. While cataracts may be treated surgically, macular degeneration can lead to permanent blindness.

Fortunately, zeaxanthin, lutein, and meso-zeaxanthin offer much-needed structural support for the aging macula. Derived from colorful fruits and vegetables, lutein and zeaxanthin protect delicate eye tissues from the dangers of oxidative stress and high-energy blue light. Unlike lutein and zeaxanthin, meso-zeaxanthin is not found in the diet, but is usually converted in the retina from ingested lutein.¹ Zeaxanthin, lutein, and meso-zeaxanthin exert broad-spectrum effects, not only helping to protect the eyes, but also providing essential support for the skin and the cardiovascular system.

XANTHOPHYLLS: NATURE'S OWN SUNSCREEN

Like the well-known nutrients beta-carotene and lycopene, zeaxanthin and lutein are carotenoids, brightly colored pigments that occur naturally in a variety of plants, particularly fruits and vegetables. Technically, zeaxanthin and lutein belong to a class of carotenoids known as xanthophylls, which are found in variously hued fruits and vegetables, predominantly in those colored yellow, orange, and green. Xanthophylls serve as natural sunscreens in plants, protecting them from the damaging effects of excessive light-derived energy.

Rich food sources of zeaxanthin include orange peppers, sweet yellow corn, honeydew, mangoes, oranges, and peaches. Lutein is found in dark green leafy vegetables, broccoli, asparagus, sweet yellow corn, squash, kiwi, pumpkin, and peas.² Egg yolks are also loaded with zeaxanthin and lutein, probably even more so than fruits and vegetables.² Some scientists now believe that eating an egg a day may help confer some of the beneficial effects of these carotenoids, while not adversely affecting serum cholesterol.³ Lutein is far more prevalent than zeaxanthin in both the human body and diet, though zeaxanthin appears to be a more chemically potent antioxidant.⁴

While short-term dietary deficiencies of zeaxanthin and lutein have not been shown to cause disease directly, scientists believe these carotenoids may be what are known as conditionally essential nutrients—that is, nutrients that, when present in optimal amounts, may offer important disease-preventive effects.⁵ Long-term depletion of zeaxanthin and lutein is associated with eye diseases, aging skin, and atherosclerosis, as well as at least one type of cancer (bladder cancer).⁵⁻⁸ This may be due to a diminished ability to defend against free-radical assault in certain body tissues—most notably, the eyes.⁵

Scientists have repeatedly demonstrated the protective effects of zeaxanthin, lutein, and meso-zeaxanthin on the eyes. High concentrations of these carotenoids are found in the macula, a specialized area of the eye's retina that is responsible for detailed vision due to its high concentration of light-detecting cone cells. The macula appears as a yellow spot in the retina, due to the presence of zeaxanthin, lutein, and meso-zeaxanthin.⁹ Accordingly, these carotenoids are commonly referred to as macular pigments.

Although other carotenoids can be found in the foods we eat, only zeaxanthin and lutein accumulate in the macula. If taken as a supplement, meso-zeaxanthin is absorbed into the bloodstream and effectively increases macular pigment levels.¹⁰ These carotenoids protect the retina by absorbing harmful ultraviolet rays and blue-green light, which can eventually damage the retina and lead to vision loss.⁹ They can thus be thought of as natural sunscreens for the eyes.



The eye lens is also rich in both zeaxanthin and lutein.⁹ The lens focuses light entering the eye on the eye's retina. Optimal health of the eye lens is essential for protecting against cataracts.

GUARDING AGAINST MACULAR DEGENERATION

Age-related macular degeneration causes the irreversible death of photoreceptors (light sensors) in the eyes, and presently has no cure. It is the most common cause of vision loss in the elderly, and its prevalence is expected to rise as the population continues to age.

More than 17 million Americans have signs or symptoms of the disease, and more than 2 million are functionally blind. Advanced disease is seen in 7% of adults over the age of 75, and early or intermediate disease is found in 25% of those over 65. Effective strategies for minimizing or slowing the progression of macular degeneration are desperately needed, as this disease causes significant disability and diminished quality of life. In addition, macular degeneration is strongly linked to both cardiovascular and cerebrovascular disease.¹¹

The major risk factor for age-related macular degeneration is the loss or decreased density of macular pigment.¹² Smoking is an additional risk factor, due to its detrimental effect on macular pigment. In macular degeneration, abnormal deposits called drusen develop in the retina and macula, damaging this cellular layer. A subtype of the disease, called wet macular degeneration, additionally involves the formation of abnormal blood vessels that grow beneath the retina.

Dietary modifications have emerged as a safe, cost-effective strategy that may delay the onset and slow the progression of age-related macular degeneration. Scientists have been studying the effects of antioxidant nutrients on age-related macular degeneration for nearly 20 years.¹³ In 1994, the Eye Disease Case Control Study showed that an increase in dietary carotenoids—particularly zeaxanthin and lutein—decreased the risk of developing wet macular degeneration.⁴

A milestone in developing treatments for macular degeneration was the Lutein Antioxidant Supplementation Trial (LAST) of 2004, which showed that supplementing with lutein and other nutrients improved the signs and symptoms of the disease. After supplementing with lutein and other nutrients for one year, the trial subjects demonstrated improved macular pigment density, as well as improvements in various aspects of visual function, including contrast sensitivity and visual acuity.¹⁴

The recent Carotenoids in Age-Related Eye Disease Study (CAREDS) of 2006—an offshoot of the Women's Health Initiative—noted a correlation between age-related macular degeneration and women's dietary intake of zeaxanthin and lutein. This trial examined nearly 1,800 women, aged 50-79, who had a high or low intake of zeaxanthin or lutein at the onset of the Women's Health Initiative. In subjects under the age of 75, those with higher intakes of lutein plus zeaxanthin (3 mg or more daily) had a 43% lower risk for intermediate age-related macular degeneration compared to those who consumed just 0.75 mg or less of lutein and zeaxanthin daily.¹⁵

Now under way, the CAREDS II trial will examine the effects of zeaxanthin, lutein, and omega-3 fatty acid intake on the progression and other aspects of age-related macular degeneration. Long-term prospective and clinical double-blind and placebo-controlled studies are needed to further elucidate the relationship between carotenoids and age-related macular degeneration.¹⁵

MESO-ZEAXANTHIN DEFICIENCY CONFIRMED IN MACULAR DEGENERATION

Patients with macular degeneration have been shown to have 30% less meso-zeaxanthin in their macula compared to healthy eyes.¹⁶ One reason for this deficiency of meso-zeaxanthin is a lack of ingested lutein. Another explanation for the missing meso-zeaxanthin observed in macular degeneration may be the inability to adequately convert lutein to meso-zeaxanthin in the retina.

Scientists conducted an autopsy study of donated eyes in order to measure levels of lutein, zeaxanthin, and meso-zeaxanthin in the retinas of those with and without macular degeneration. As expected, levels of all three carotenoids were reduced in those with macular degeneration compared to control subjects. The most significant finding, however, was the sharp decrease in meso-zeaxanthin in relation to zeaxanthin in the maculas of those with macular degeneration.¹⁷ This post-mortem study helped confirm other studies indicating the importance of all three carotenoids in maintaining the structural integrity of the macula.

Some people with age-related macular degeneration have difficulty in synthesizing meso-zeaxanthin from lutein in the body, thereby creating a severe meso-zeaxanthin deficiency in their maculas. Recent studies using a device that measures the thickness of the macula showed that in response to meso-zeaxanthin supplementation, macular pigment density increased.¹⁰ Scientists now believe that people who have a high intake of lutein and zeaxanthin (from either dietary sources or supplements) and who also take supplemental meso-zeaxanthin will have a very low incidence of macular degeneration.

VITAL PROTECTION AGAINST CATARACTS

In addition to preventing and slowing the progression of age-related macular degeneration, zeaxanthin and lutein may protect against the development and clinical progression of cataracts. Cataracts occur as the lenses of the eyes gradually and painlessly become opaque, leading to impaired vision. A large proportion of elderly Americans exhibit some sign of cataracts.

The Nurses Health Study examined the impact of 12 years of carotenoid consumption on cataract formation in more than 77,000 female nurses over the age of 45. After controlling for factors such as age and smoking, women with the highest intake of zeaxanthin and lutein had a 22% lower risk of cataract extraction (defined as cataracts severe enough to require surgical removal). More frequent intake of spinach and kale—two foods rich in lutein—was also linked to a moderately lower risk of cataract.¹⁸



Another study examined the effects of lutein and vitamin E on visual function in adults with age-related cataracts. Seventeen patients with clinically diagnosed cataracts participated in this randomized, placebo-controlled study. They supplemented with 15 mg of lutein, 100 mg of vitamin E (as alpha-tocopherol), or a placebo, three times a week for up to two years. Visual performance and serum levels of lutein and vitamin E were measured every three months. Those who supplemented with lutein demonstrated improvements in visual performance, including visual acuity and glare sensitivity. By contrast, visual function was merely maintained in the vitamin E group, while actually deteriorating in the placebo group. Higher intake of lutein may thus help improve visual function in adults with age-related cataracts.¹⁹

Despite findings suggesting that abundant intake of lutein, zeaxanthin, and meso-zeaxanthin can help reduce the risks of these two primary sight-robbing diseases,⁹ the FDA has not approved qualified health claims that these nutrients can help prevent age-related macular degeneration or cataracts. More comprehensive studies will be needed in order to secure this approval.²⁰

BENEFITS FOR SKIN HEALTH

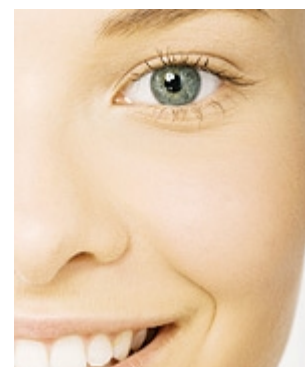
The health benefits of zeaxanthin and lutein are not limited to the eyes. Just as these carotenoids protect the eye's macula and lens, they may similarly protect the skin against detrimental age-related changes, such as reduced flexibility, hydration, and lipid content.

In a placebo-controlled study titled "Clinical Evidence for Lutein and Zeaxanthin in Skin Health," a combination of orally consumed and topically administered lutein produced numerous benefits for the skin. These included improvements in skin hydration, skin elasticity, and concentration of superficial skin lipids. Lipid oxidation, which leads to skin aging, was also decreased. These skin health benefits were greatest in subjects who both consumed oral lutein supplements and applied a topical lutein formulation. Notably, it was lutein supplements—rather than intake of lutein from food sources—that led to improvements in the skin's youthfulness.⁶

EVIDENCE OF CARDIOVASCULAR PROTECTION

Zeaxanthin and lutein may also help prevent atherosclerosis, a primary contributor to heart attacks, strokes, and peripheral vascular disease.

In the 18-month Los Angeles Atherosclerosis Study, scientists tracked 573 middle-aged men and women who were free of symptomatic cardiovascular disease. Subjects with higher baseline blood levels of zeaxanthin and lutein demonstrated a decrease in carotid intima-media thickness at the study's completion. Since increased carotid intima-media thickness signifies the progression of atherosclerotic disease, these findings suggest that zeaxanthin and lutein helped protect against early atherosclerosis.⁸ Researchers speculate that the antioxidant effects of zeaxanthin and lutein are likely responsible for their cardioprotective effects.



DOSAGE, ABSORPTION, AND SAFETY

Epidemiological studies indicate that humans need to consume approximately 6-20 mg of lutein and zeaxanthin daily to realize their beneficial health effects.⁴ While diets rich in fruits, vegetables, and egg yolk can increase levels of zeaxanthin and lutein, it may be difficult to achieve optimal amounts through dietary sources alone. Meso-zeaxanthin, which makes up 25% of the structural density of the macular pigment, is virtually absent from all diets. Supplementing with zeaxanthin, lutein, and meso-zeaxanthin may be the best way to ensure that you are ingesting optimal amounts of these critical nutrients.

Zeaxanthin and lutein are fat soluble, and may be best absorbed when consumed with a source of dietary fats. Certain

cholesterol-lowering medications, including cholestyramine (Questran®) and colestipol (Colestid®) may reduce the absorption of fat-soluble carotenoids. Mineral oil, corn oil, and olestra may also inhibit the absorption of zeaxanthin and lutein.²¹

Zeaxanthin and lutein are considered safe and well tolerated, with no adverse effects or toxicities reported at doses of up to 40 mg daily for two months. Since studies in pregnant women and nursing mothers have not yet been conducted, these women should obtain zeaxanthin and lutein through dietary sources until more information is available.²¹



CONCLUSION

For most adults, a life without the gift of vision is simply unimaginable. Yet like so many age-related afflictions, vision problems like cataracts and age-related macular degeneration are commonly accepted as an inevitable consequence of growing older.

Fortunately, a proactive nutritional strategy that incorporates abundant intake of the carotenoid antioxidants zeaxanthin, lutein, and meso-zeaxanthin can provide targeted protection for your eyes, while conferring additional health benefits for the skin and heart.

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