Dynamic Chiropractic

VITAMINS / SUPPLEMENTS

Lutein and Zeaxanthin: Seeing Into the Heart of the Matter

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> "*[T]he effort to understand the health benefits of plant foods ... is the characterization of their physiologically active constituents, phytochemicals. ... As our knowledge grows ... we will learn how best to create new products through altering their concentrations, combinations and/or their bioavailability.*"
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> - Functional Foods for Health Program, Department of Food Science and Human Nutrition, University of Illinois, Urbana, Ill.

Lutein and zeaxanthin are carotenoid phytonutrients, integral to protecting vision and optimizing cardiovascular health.[1] Phytonutrients can be classified into seven major groups: terpenes, amines, organosulfurs, phenols, polysaccharides, organic acids, and isoprenoid lipids. The carotenoids, perhaps the most familiar of phytonutrients, are a subgroup of the fat-soluble terpenes, along with the chromanols, saponins and limonoids.[2] Chemically, carotenoids are classified into two main groups: carotenes, such as beta-carotene and lycopene; and xanthophylls, including lutein, zeaxanthin, beta-cryptoxanthin, canthaxanthin, and astaxanthin.

Carotenoids function as membrane antioxidants due to their reactivity with singlet oxygen. In this article, I will focus on two specific xanthophylls - lutein and zeaxanthin.

Leafy green vegetables, corn, and egg yolk are rich in the yellow-colored lutein and its usual companion, zeaxanthin, from which the color of the former garners its name.[3] Peaches, oranges, papaya, kiwi, squash, peas, lima beans, green beans, broccoli, brussels sprouts, prunes, pumpkin, potatoes, sweet potatoes and honeydew melon also contain lutein and zeaxanthin. Marigold is so rich in lutein and zeaxanthin that it is the major source for supplementation.[4] Egg yolk may be the most bioavailable source.[5] Lutein and zeaxanthin, like all terpenes, are lipophyllic, requiring fat for optimal uptake.[6] It is not unlikely that the lutein in egg yolk provides greater bioavailability because of the yolk's rich lipid and phospholipid content, which is ideal for liposome formation. (Liposomes are nanosized lipid vesicles in which oils, oil-soluble nutrients and fatty acids are absorbed in the small intestine and then taken up directly by the lymph system.) I should also point out that dietary fiber inhibits absorption of lutein by 40 percent to 75 percent.[7]

Oh Say, Will You See?

Lutein and zeaxanthin are carotenoids without pro-vitamin A activity. They are the only carotenoids identified in the macula, the central part of the retina that controls fine vision. There, they filter harmful blue light, thereby inhibiting oxidative damage in the cell membranes. Such damage leads to macular degeneration, particularly age-related macular degeneration (AMD), which affects over

30 million people worldwide and is the leading cause of blindness in people over age 50.[8]

Since there is no cure for AMD, prevention is crucial. Supplements and lutein-rich foods can increase the macular pigment density, which has been shown to be associated with a lower risk of AMD. Indeed, a stable intake of the carotenoids lutein and zeaxanthin could reduce the risk of AMD by 43 percent in women under age 75, says Suzen Moeller, from the University of Wisconsin.[8] "This exploratory observation is consistent with a broad body of evidence from observational and experimental studies that suggests that these carotenoids (lutein and zeaxanthin) may protect against AMD," writes Moeller, who led a new cohort study on the subject.[8]

Nonetheless, it is still not clear whether lutein and zeaxanthin by themselves are responsible for the changes, as compared to the total effect of other carotenoids, phytonutrients and micronutrients consumed along with high-lutein/zeaxanthin foods.

"More conclusive evidence from long-term prospective studies and clinical trials is needed to determine whether the intake of macular carotenoids themselves, or as markers of broader dietary patterns, can protect against intermediate AMD or delay progression in individuals who have early stages of the disease," says Moeller (emphasis added).[8]

The effects appeared to be strongest among those with lifelong high intakes. This suggests that just adding lutein to vitamin pills for people over age 50 may not be as efficacious as more complete and balanced nutrition over a lifetime.

Let's Have a Heart-to-Heart

In America, cardiovascular disease (CVD) is the leading cause of death. Researchers from the University of Southern California and the University of California, Los Angeles, believe lutein may help to reduce the risk of CVD. A recently published article in the journal *Circulation* describes the effect of lutein on the progression of atherosclerosis.[9] Atherosclerosis is the thickening of arterial walls due to buildup of fatty plaque, a leading cause of CVD.

Investigators performed three separate studies. They demonstrated that increased lutein levels present in the blood serum had a desirable effect on arterial wall thickness. The higher the serum lutein levels, the less the arterial thickening and the less the risk of CVD. A follow-up study also found higher serum lutein levels at baseline were associated with reduced arterial wall thickness progression over 18 months.[10]

In the prospective Health Professionals Study, a high dietary intake of lutein had a modest association with a reduced risk of ischemic stroke.[11] In the Alpha-Tocopherol, ß-Carotene Cancer Prevention Study (The ATBC Study), conducted in Finland, lutein plus zeaxanthin was associated with a lower risk of subarachnoid hemorrhage.[12] In the Atherosclerosis Risks in Communities Study, Iribarren, et al., noted that lutein plus zeaxanthin concentrations were inversely related to the extent of atherosclerosis.[13]

Magic Yellow Bullets?

Clearly, nutrition has a significant role in the prevention of many chronic diseases, such as CVD and AMD. It is well-known that a greater intake of fruit and vegetables can help prevent most of the common diseases associated with aging. However, as plant foods are chemically complex, it is

difficult to pinpoint any single nutrient that is most responsible for their protective effects. Potentially beneficial substances include vitamins and minerals, fiber, and phytonutrients. A review by the Research Institute of Public Health, University of Kuopio, Finland, discusses the role of main dietary carotenoids (i.e., lycopene, beta-carotene, alpha-carotene, beta-cryptoxanthin, lutein, and zeaxanthin) in the prevention of heart diseases. In their abstract, the authors report, "Although it is clear that a higher intake of fruit and vegetables can help prevent the morbidity and mortality associated with heart diseases, more information is needed to ascertain the association between the intake of single nutrients, such as carotenoids, and the risk of CVD. Currently, the consumption of carotenoids in pharmaceutical forms for the treatment or prevention of heart diseases cannot be recommended."[14]

Scanner or Scammer?

In the 1990s, a device using a safe blue light and a technology called Raman Spectroscopy was made available for ophthalmologists. This tool could scan the retina and measure lutein and zeaxanthin to discern AMD risk. It soon was discovered that this laser scanner also could measure some carotenoids in the skin of the palm.

From this analysis, the total antioxidant status cannot be determined as such, but an initial pilot study suggests that it nonetheless may be a good indicator of fruit and vegetable intake, antioxidant nutrition, and oxidative stress.[15] Of course, this presumes no skewing of the results via supplementation heavily weighted in carotenoids. Such supplementation would increase scores, but would be more reflective of carotenoid status as such, and no longer as reflective of fruit and vegetable intake, antioxidant nutrition, and oxidative stress. Nonetheless, this easy-to-use, portable tool, now available to doctors in general, including chiropractors, gives instant results and is noninvasive - not requiring bodily fluids, tissue samples or a laboratory.

Scientific Supplementation

The current recommendation for lutein is as high as 6 mg a day. The average American is thought to consume 1-2 mg a day. Recommended intake of zeaxanthin is 1 mg a day.[16] Although lutein, sometimes along with zeaxanthin, is being added more and more to multivitamins and antioxidant pill formulas, or being sold as a separate product, we should keep the following in mind, which echo the conclusions above:

- "[F]ruits and vegetable phytochemical extracts exhibit strong antioxidant ... activities ... from the combination of phytochemicals ... the additive and synergistic effects of a 'complex mixture' of phytochemicals ... are responsible for these the benefits ... no single antioxidant can replace the combination of natural phytochemicals."[17]
- "[P]hytochemicals often appear in nature as families of related compounds [that] ... may behave synergistically ... and ... activate metabolic enzymes ... as a network."[18]

We have already learned that marigold is the best plant source. Therefore it is likely wisest to provide several milligrams of marigold-derived lutein and zeaxanthin in a 5:1 ratio, in a natural, complex matrix that includes a wide variety of carotenoids and other phytonutrients from all the seven major groups, in a whole-food base.

To maximize bioavailability, carotenoid supplementation is best taken away from high-fiber meals. But we need to consider yet another factor:

"[A]ntioxidants, which are found in many phytochemicals ... are biologically unstable, poorly soluble in water, and poorly distributed to target sites ... we strongly advocate serious

consideration of the bioavailability of dietary supplements ... to improve their bioavailability using delivery systems such as liposomal formulations."[19]

Being lipophillic, carotenoid supplements should be taken with fat to allow for liposome formation. Liposomes are nanosized "fat bodies" that infuse non-water-soluble fats so they can be absorbed.[20] They also protect carotenoids from gastric juices, which can destroy 50 percent of ingested carotenoids.[21]

Therefore, in order to maximize bioavailability and compliance simultaneously, the best solution may be to infuse the carotenoids in liposomes as well. In this way, lutein can be supplemented without having to ingest fat at the same time, thereby enhancing overall compliance.

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