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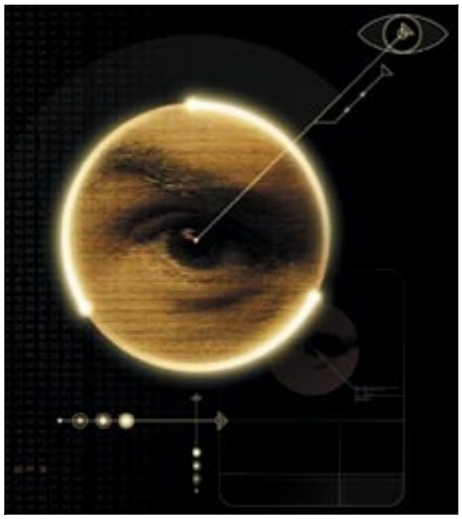
REPORT

Macular Degeneration Epidemic
How Aging People Can Preserve Their Eyesight



The aging process inflicts devastating effects to the eyes, yet lifestyle changes may reduce the most common ocular disorder by as much as 82%! While the majority of aged people suffer from visual impairment, scientists are discovering low-cost methods of restoring macular pigment density and preserving eyesight. A consensus of published scientific findings reveals that the risk of blinding eye disease can be drastically reduced. The macula is the central part of the retina that is responsible for visual sharpness and detail. Age-related macular degeneration (AMD) is the leading cause of irreversible blindness in the US. The Beaver Dam Eye Study estimates that 25% of the population over age 65 has clinical evidence of the disease, a risk that increases with advancing age.[1]

by Angela Pirisi

While countless studies demonstrate an association between consumption of carotenoids with lowered risk of cancer and cardiovascular disease, these nutrients have also been found to help preserve eye health. Two in particular, lutein and zeaxanthin, have been the focus of much research lately.

Lutein is a pigment found in dark, green, leafy vegetables, including spinach, kale, broccoli, collard greens, etc. Zeaxanthin is found in fruits and vegetables with yellow hues, such as corn, peaches, persimmons, mangoes, etc. They are often lumped together when discussed or studied because they are structurally very similar, found in many of the same foods, and both are present in the retina. Lutein and zeaxanthin have been found to positively affect macular pigment density and to help prevent age-related macular degeneration (AMD).

At risk

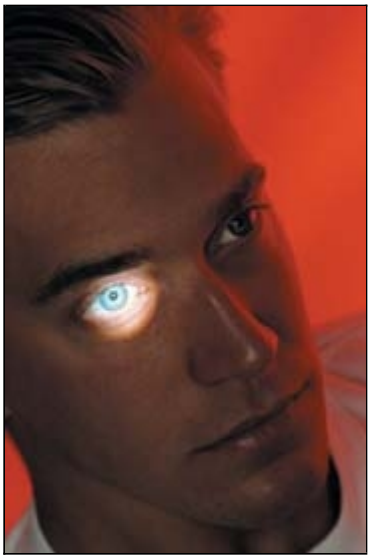
Scientists now theorize that cumulative oxidative stress may be largely to blame for age-related macular degeneration, since it is the primary culprit responsible for photochemical retinal injury. Such findings are supported by the fact that the retina is particularly susceptible to oxidation because of its high consumption of oxygen, its high proportion of polyunsaturated fatty acids, and its exposure to visible light.[2]

Age is another known risk factor for AMD, since macular density decreases over time. Macular pigment has been shown in many studies to limit retinal oxidative damage by absorbing incoming blue light and/or quenching reactive oxygen intermediates (ROIs).[3] Research findings point to low or diminished concentrations of macular pigment as lending to an increased risk of AMD, because they allow for more blue light damage.[4]

Epidemiological studies have identified risk factors, such as smoking,[5-7] excess alcohol consumption and lifetime UV exposure,[9,10] all of which have been shown to speed the progress of the blinding disease. In addition, an emerging risk factor is low dietary intake of fruits and vegetables, a widespread problem since the U.S. Department of Agriculture estimates that only a small percentage of Americans eat enough green, leafy vegetable each day. Studies to date suggest that carotenoids and antioxidant vitamins found in many fruits and vegetables may help to retard retinal oxidative damage that leads to age-related macular degeneration.[11]

Genes and gender

Besides the factors listed above, individual variability in macular pigment density has made scientists wonder whether some people are more at risk for AMD.[12,13] The question is, What determines that variability? For instance, studies have suggested that being female and having light-colored irises increase the risk of AMD. It is hard to tell yet exactly how these factors and others relate to retinal concentrations of carotenoids, macular density and AMD risk. For example, researchers at the Schepens Eye Research Institute in Boston found that sex differences may figure into how well protected the retina is from macular degeneration.[14] Study results showed that males had 38% higher macular pigment density than females despite similar plasma carotenoid concentrations and similar dietary intake (except for fat). While dietary intake of carotenoids, fat and iron, as well as plasma concentrations of lutein and zeaxanthin were related to increased macular pigment density in males, only plasma lutein and zeaxanthin were related to increased macular pigment density for females, and dietary fat was related to decreased macular pigment density.



Research findings point to low or diminished concentrations of macular pigment as lending to an increased risk of AMD, because they allow for more blue light damage.

Researchers at Indiana University found that macular pigment concentrations are related to both serum levels and dietary intake of lutein and zeaxanthin, as well as fiber intake and iris color.[15] They assessed in 280 healthy volunteers (138 men, 142 women) ages 18 to 50 which dietary factors and personal characteristics might account for individual variation in the density of the macular pigments, lutein and zeaxanthin. Using serum testing for carotenoid and vitamin E status, a food questionnaire to determine nutrient intake, and measurements of macular pigment density, the authors found that macular pigment density was 44% lower in the bottom versus the top quintile of lutein and 33% lower in the bottom versus the top quintile of serum zeaxanthin concentrations and intake.

But sex and genetics do not seal one's fate, as one group of researchers found. A study set out to examine whether macular pigment density is genetically determined, or if dietary intake of carotenoids, such as lutein and zeaxanthin, are contributing factors.[13] Researchers measured macular pigment density, serum carotenoid concentrations, and general dietary patterns in 10 pairs of identical twins. There were statistically significant differences in macular pigment optical density in five of the 10 twin pairs, which were related to differences in dietary consumption of fat, iron, linoleic and oleic acid, fiber and total calories. However, there was no significant relationship between macular pigment density and carotenoids in the blood and diet. The investigators concluded that variations in macular pigment density are not completely genetically determined, and that it can be manipulated by other means such as diet. More specifically, the findings suggest that dietary fat, iron and fiber may influence macular pigment levels, possibly because of their influence on carotenoid metabolism.

Age and nutrition

But what is the definitive role of age and nutritional deficiency in causing AMD to occur or to worsen? According to Paul S. Bernstein, M.D., Ph.D., an associate professor of ophthalmology at the University of Utah's Moran Eye Center, "In our studies using Raman spectroscopy to measure macular pigment levels, we find a definite decline with age. Also AMD patients have 32% lower levels than age-matched control subjects. AMD patients who have begun taking high-dose lutein supplements (4 mg or more per day) appear to return to 'normal' levels after a few months. These findings are consistent with the hypothesis that a long-term deficiency of macular carotenoids may be associated with higher risk of AMD."

A number of studies now show that consuming lutein and zeaxanthin from rich food sources or through supplementation can increase macular pigment density and lower AMD risk, or at least slow its progression in those already afflicted by the disease.[4,16] Researchers in The Netherlands found that supplementation with lutein significantly increased the density of the macular pigment after just one month.[17] They asked eight subjects to take 10 mg lutein per day for 12 weeks to assess its effect on their macular density. They found that by four weeks, the mean blood level of lutein had increased from 0.18 to 0.90 micromoles, and that it maintained that concentration level until stopping supplementation for four weeks. Macular pigment density also showed a mean linear four-week increase of 5.3% and 4.1%, using two different measurement techniques, respectively.

One study found that those with a higher dietary intake of carotenoids had a lower risk for AMD. Those consuming lutein-rich foods five days per week were eight times less likely to develop macular degeneration as those consuming them once per month, asserted another study by Harvard researchers.[18] The study comprised a sample of 356 case subjects from the multicenter Eye Disease Case-Control Study diagnosed with the advanced stage of AMD within one year prior to their enrolment, aged 55 to 80 years, and 520 control subjects. Looking for a link between dietary intake of carotenoids and vitamins A, C and E, and the risk of neovascular age-related macular degeneration (AMD), results showed that those in the highest quintile of carotenoid intake had a 43% lower risk for AMD compared with those in the lowest quintile. Moreover, lutein and zeaxanthin were most strongly associated with a reduced risk, particularly sources such as spinach and collard greens. Meanwhile, there was no noteworthy link between vitamin A (retinol), vitamin E, or total vitamin C consumption and reduced risk for AMD.

Researchers at the University of New Hampshire too found a significant correlation between dietary intake and serum levels of lutein

and zeaxanthin, and significantly related to variation in macular pigment density.[19] They recruited 280 volunteers in the Indianapolis area to complete health and diet questionnaires, donate a blood sample, and submit to a macular pigment density assessment to determine retinal carotenoid status. Meanwhile, at the University of Florida, results from a study looking at retinas from 56 donors and 56 controls for the amounts of lutein and zeaxanthin indicated that those in the highest quartile of lutein and zeaxanthin levels had an 82% lower risk for AMD compared with those in the lowest quartile.[20]

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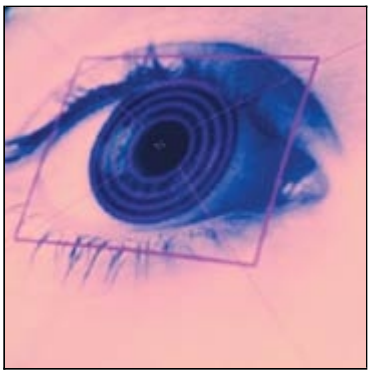
REPORT

Carotenoids and macular pigment

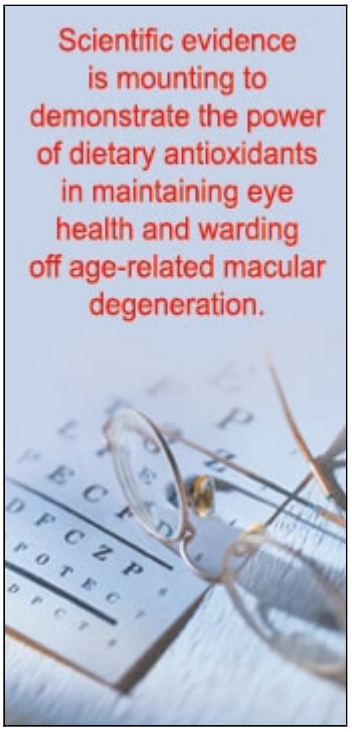


Scientific evidence is mounting to demonstrate the power of dietary antioxidants in maintaining eye health and warding off age-related macular degeneration. The most recent study to raid the headlines was the Age-Related Eye Disease Study (AREDS), which was carried out by the National Eye Institute. The large, multicenter study showed that a daily intake of 500 mg of vitamin C, 15 mg of beta carotene, 400 IU of vitamin E and 80 mg of zinc reduced the risk of developing advanced disease in those with intermediate damage by about 25%.[21]

Other research has more specifically set its sights on examining the protective role of the carotenoids, lutein and zeaxanthin, against macular degeneration. Why? With several hundred carotenoids to be found, consider that only lutein and zeaxanthin are found in the retina.[22,23] Compared to other antioxidant concentrations found in the eye, German researchers found that lutein and zeaxanthin did not break down nearly as fast as lycopene and beta-carotene when exposed to free radical or UV light induced oxidative stress.[24] The authors suggest that perhaps the slow degradation of lutein and zeaxanthin may explain the strong presence of these carotenoids in the retina. Also, the quick breakdown of lycopene and beta-carotene may suggest why these carotenoids are lacking in the same retinal tissues.

Researchers have also found that lutein and zeaxanthin are more highly concentrated in the center of the macula. There, the amounts of lutein and zeaxanthin are much greater than their concentrations in the peripheral region. At the Baylor College of Medicine, in Houston, scientific investigators demonstrated, using retinas from human donor eyes, that the concentration of lutein and zeaxanthin were 70% higher in rod outer segment (ROS) membranes where the concentration of long-chain polyunsaturated fatty acids, and susceptibility to oxidation is highest, than in residual membranes.[25] The fact that lutein and zeaxanthin are particularly concentrated in these parts of the eye suggests that they may act as a shield or filter that helps to absorb harmful UVB light and dangerous free-radical molecules, both of which threaten the retinal tissue.[26,27]

Moreover, while macular pigment density decreases with age, and the risk of AMD increases-a coincidence that cannot be overlooked-researchers have also found that older folks with higher lutein and zeaxanthin concentrations in their macula tend not to develop the disease. Researchers at Arizona State University suggested that increasing macular pigment through dietary intake of lutein and zeaxanthin may retard age-related declines in visual function, and that high macular pigment density was associated with the retention of youthful visual sensitivity.[28] After measuring the macular pigment density and visual sensitivity of 27 older subjects (aged 60 to 84 years) and 10 younger ones (aged 24 to 36 years), results showed that older subjects with high levels of lutein and zeaxanthin had visual sensitivity comparable to younger subjects. Conversely, older subjects with low lutein and zeaxanthin in their macula had lower visual sensitivity.



Weighing all the evidence to date, it stands to reason that increasing or maintaining levels of the carotenoids that make up the pigment, namely lutein and zeaxanthin, would support the protective role of macular pigment. While larger and longer trials will bear out what research now seems to suggest, increasing our lutein and zeaxanthin intake through diet seems to be a safe bet. However, nutritional scientists have not yet pinned down ideal amounts to recommend for lutein and zeaxanthin supplements. Bernstein explains that we currently hear much more about lutein, "since it is much more common in our diet, and commercial supplements of lutein have been available for a much longer time. Zeaxanthin supplements have been approved for human use only recently." For the time being, though, Bernstsein suggests consuming a diet high in fruits and vegetables. He adds that daily supplementation with at least 4 milligrams of lutein per day may be beneficial, but further studies are needed.

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