

# Lutein and Zeaxanthin are Good for Your Eyes

You've probably heard that lutein and zeaxanthin are good for the eyes. These two major *carotenoids* found in the macula and retina are sometimes called xanthophylls or macular pigment. They function as *antioxidants* and also help protect tissues from phototoxic damage by filtering out some of the blue light.

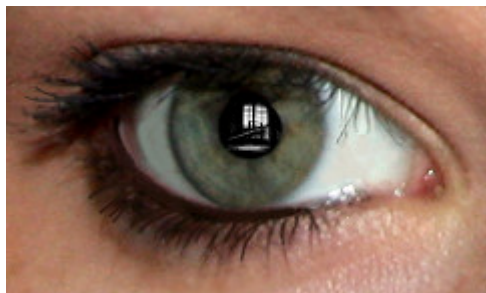


Photo by [K Conkling](#) 

The eye, and particularly the macula and retina, are almost constantly subjected to free radical generation and oxidative damage. Just as exposure to too much sunlight can damage the skin, so too can light damage the eyes. It is, thus, critical that you maintain your basic nutrients and especially antioxidants in the eye.

A study of macaque monkeys (with eyes similar to humans) showed that there was more zeaxanthin than lutein in the central fovea where vision is most clear. But, the concentration of zeaxanthin is reduced the further you get from the fovea and lutein dominates.

The macula has a yellow tint due to the presence of lutein, zeaxanthin and another xanthophyll called meso-zeaxanthin. It's these pigments that help filter out or absorb some of the more damaging blue light to help protect the eye.

## What the Studies Show

Carotenoids are especially important because they seem to help prevent age related macular degeneration. A study indicated that getting high levels of carotenoids (especially in dark green leafy vegetables) in the diet results in a 43% lower risk of age related macular degeneration, the leading cause of blindness.

The original Age-Related Eye Disease Study showed that antioxidants (vitamin C, vitamin E, beta carotene, and zinc) reduced the risk of age related macular degeneration by 25%.

The second Age-Related Eye Disease Study showed beneficial effects of adding lutein and zeaxanthin to the mix for preventing late stage age related macular degeneration.

Another study showed that lower levels of the antioxidant lycopene in the blood was associated with age related macular degeneration.

A study of monkeys who were feed a diet with no plant pigments for several years found that these pigments dissppear in the macula. And retinal abnormalities resembling age relate macular degeneration appeared.

Overall, there is an inverse relationship between the amount of macular pigment and age related macular degeneration. The more pigment the less macular degeneration. The less pigment, the more macular degeneration.

The Third National Health and Nutrition Examination Survey (NHANES III) examined the contents of lutein and zeaxanthin in the blood and found a wide variation. The quarter of the people with the lowest concentration averaged 0.19  $\mu\text{Mole/L}$  while the average concentration for the upper quarter of the people was 0.79  $\mu\text{Mole/L}$ . This is a difference of greater than 4 to 1.

## **How to Get Natural Antioxidants**

Lutein and zeaxanthin cannot be synthesized or made within the body. They must come from external sources. If not in a supplement, they come almost entirely from plant sources.They may also come indirectly from plants through animals that eat plants.

The most important source of carotenoids are fruits and vegetables.

The best natural sources of both lutein and zeaxanthin are egg yokes and corn, both of which are yellow.

Most other fruits seem to supply more lutein or more zeaxanthin. For example, orange pepper has close to 5.6 time more zeaxanthin than lutein. But green pepper has 13 times more lutein than zeaxanthin.

Overall, most vegetables supply more lutein than zeaxanthin. Topping the list are egg yoke and corn. Other good sources for lutein and zeaxanthin include:

- Kiwi
- Red seedless grapes
- Zucchini squash
- Pumpkin
- Spinach
- Orange pepper
- Yellow squash
- Cucumber
- Peas
- Green pepper
- Red grapes
- butternut squash

- Orange juice
- Honeydew
- Celery stalks and leaves
- Green grapes

## Conclusions You Can Use

Lutein and zeaxanthin are important components of eye health. These and other antioxidants are important to help reduce the likelihood of a number of eye problems including macular degeneration, cataracts and retinitis pigmentosa.

## References

- [Fruits and vegetables that are sources for lutein and zeaxanthin: the macular pigment in human eyes](#) as published in the *British Medical Journal*
- [BIOLOGIC MECHANISMS OF THE PROTECTIVE ROLE OF LUTEIN AND ZEAXANTHIN IN THE EYE](#) as published in the *Annual review of nutrition*
- [Secondary Analyses of the Effects of Lutein/Zeaxanthin on Age-Related Macular Degeneration Progression AREDS2 Report No. 3](#) as published in the *Journal of the American Medical Association: Ophthalmology*
- [The Body of Evidence to Support a Protective Role for Lutein and Zeaxanthin in Delaying Chronic Disease. Overview](#) as published in the *American Society for Nutritional Sciences*

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## Age-Related Macular Degeneration and What You Can Do

Age-related macular degeneration affects nearly 2 million Americans. More than 7 million Americans are at substantial risk for developing age-related macular degeneration. Some estimate that nearly 3 million people will be affected by 2020. Macular degeneration is the leading cause of central visual impairment that affects reading, driving, recognizing faces and performing close-up work among people aged 65 and above.

### What Causes Age-Related Macular Degeneration?

The exact way age related macular degeneration develops is unknown. But, oxidative stress of the retina is thought to be a major contributor. The high concentration of oxygen and exposure to intense light seem to make the retina susceptible to oxidative damage.

Smoking is a well known way to deplete antioxidants. Smoking also increases

blood viscosity and constricts blood vessels thus reducing the blood flow to the eyes. Every cigarette you smoke does damage to your eyes.

As the name ("age-related" macular degeneration) implies, age also plays its part. The aging of the retinal pigment epithelial layer and Bruch's membrane (the layer below the epithelial layer) can allow the accumulation of debris and drusen. And, any existing abnormality typically worsens with age causing further damage and dysfunction of the retinal pigment epithelial layer.

Once the retinal pigment epithelial cells are damaged they secrete several growth factors including vascular endothelial growth factor (VEGF) which encourages the growth of new blood vessels (choroidal neovascularization) that cause problems in the "wet" form of age-related macular degeneration.

High BMI (body mass index) is also associated with increases in the late stage of the dry form of age related macular degeneration. Those in the obese category (BMI>30) compared to those with a "normal" BMI (ranging from 18.5 to 24.9) had nearly twice the incidence of this severe form of macular degeneration.

Exposure to bright, ultra-violet light increases (as does oxidative stress) after cataract surgery because the human lens helps reduce ultra-violet transmission to the retina.

Cardiovascular disease along with high cholesterol and hypertension (high blood pressure) are associated with the "wet" or neovascular age-related macular degeneration. Even subclinical cardiovascular disease with plaques in the artery walls increases the likelihood of late state age-related macular degeneration by 5 times.

Genetics can predispose a person to get age-related macular degeneration. It is more prevalent in some families indicating a genetic factor. Genetics along with environmental stress make the disease more likely. Certain chromosomal regions seem to be associated with the disease, including 1q31-32, 6q21 and 10q26.

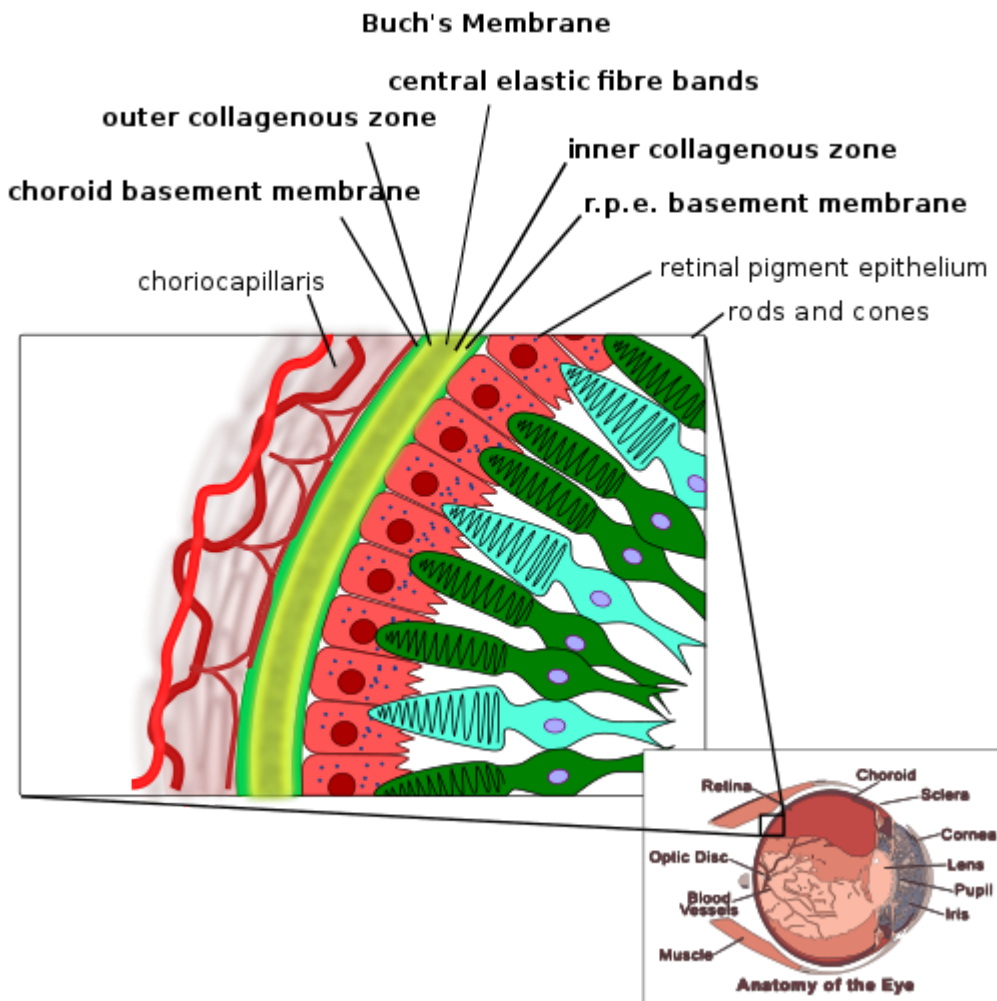
A poor diet low in antioxidants, low in omega-3 fatty acids, and low in leafy green vegetables does not provide protection. Unfortunately, the increasingly popular habit of eating manufactured foods and at fast food restaurants is leading, in many ways, to a sick population that is getting sicker as the years go by.

## **Difference Between Wet and Dry Macular Degeneration**

While that main effect of age-related macular degeneration is the reduction in central vision, there are two causes for this impairment. They are designated "dry" and "wet" macular degeneration.

Dry age related macular degeneration is characterized by "drusen" which are yellow deposits forming under the macula. As these deposits build up they cause the retinal pigment epithelium and photoreceptors to atrophy. There are three stages of dry age related macular degeneration: early, intermediate and

late. These stages are characterized by the size of the drusen deposits and the degree of atrophy in the retinal pigment epithelium and photoreceptors. The intermediate stage is when a person begins to have trouble reading, recognizing faces, and having trouble adapting to changes in lighting.



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Wet age-related macular degeneration is caused by the abnormal growth of blood vessels under the retina. These blood vessels are delicate and often leak, producing a spontaneous hemorrhage. The scarring from the broken vessels causes irreversible damage to the macula. Such damage produces the most drastic loss of central vision. This “wet” version can develop on its own or it can be the result of the “dry” version.

Around 90% of age related macular degeneration is of the “dry” variety while 10% is the “wet” variety.

### What is Macular Degeneration?

Macular degeneration is a disease which affects the retina. In this video we will describe the symptoms of macular degeneration. The retina is the layer at the back of the eye which helps us to see the world around us.

# First Signs of Macular Degeneration

Before any visual problems are noticed an ophthalmologist can detect drusen within the retina.

Drusen are small yellow or white deposits just under the retina. While the presence of drusen in people over aged 60 is normal, the risk of age-related macular degeneration increases significantly when the drusen are large or are numerous. The thickness of the drusen is related to the degree of degeneration of the retinal pigment epithelium and vision loss.

## Can Macular Degeneration be Prevented?

Preventive measures usually fall under three categories:

A number of nutritional clinical trials have been conducted to determine what nutrients work to delay or prevent age-related macular degeneration.

### AREDS Formulation of Nutritional Supplements

The "Age-Related Eye Disease Study" and the followup study "Age-Related Eye Disease Study 2" produced formulations of nutrients that reduced the risks of advancing to the advanced stage of age-related macular degeneration.

But, it was noticed that the vitamin A as beta carotene seemed to increase cancer risks in mostly former smokers. A second study (AREDS2) was performed to replace beta carotene. The final formulation consists of:

- Antioxidant vitamin C
- Antioxidant vitamin E
- Omega-3 long-chain polyunsaturated fatty acids
- Lutein + Zeaxanthin
- Copper
- Zinc

### Does everyone need to take the AREDS2 vitamins for their eye health?

Lutein and zeaxanthin are carotenoids (plant pigments) that exist in high concentrations in the macula. They act as short-wavelength light filters that help reduce oxidation. Because the human body cannot make lutein, it must come from the diet or supplements.

Neither lutein nor zeaxanthin were available during the first AREDS study because they could not be manufactured in a research formulation. But, they are now available from several reliable sources.

Omega-3 fatty acids have been known for some time to help reduce cardiovascular disease and strokes. Its qualities of helping to reduce inflammation and regulate the autoimmune response make it an ideal addition the to AREDS2 formulation to help prevent the advance of age-related macular degeneration.

## Berry Extracts

Many people are interested in berries for their antioxidant properties. Though not extensively studied, the most important berries for their antioxidant properties are:

1. Blueberry
2. Goji berry (also called wolfberry)
3. Anthocyanin (found in blueberry, raspberry, black rice, and black soybean)

## Lifestyle Changes

Lifestyle changes include:

- Smoking cessation
- Reducing BMI
- Reducing light exposure (sunglasses)

## Can Drugs Reverse Macular Degeneration?

There are currently no drug treatments to regain lost vision.

FDA accepted treatments are available for the “wet” form of age-related macular degeneration only. These drugs are intended to prevent the further creation of additional blood vessels under the retina. As already mentioned, the deterioration of the retinal pigment epithelial cells produce vascular endothelial growth factor (VEGF) which encourages the growth of these new, weak blood vessels. The treatment involves injecting anti-VEGF drugs into the eye near the retina.

The costs for these drugs is high and multiple injections are required.

At the time this is written there are [322](#) clinical trial in progress dealing with macular degeneration. A few of these are:

- [Managing Neovascular \(Known as “Wet”\) Age-related Macular Degeneration Over 2 Years Using Different Treatment Schedules of 2 mg Intravitreal Aflibercept Injected in the Eye](#)
- [Evaluation of Visual Function and Driving Health Using Ocusweep in Patients Suffering From Wet Age-related Macular Degeneration](#)
- [Age-related Macular Degeneration \(AMD\) in the Vitamin D and Omega-3 Trial \(VITAL\)](#)
- [Clinical Study of Subretinal Transplantation of Human Embryo Stem Cell Derived Retinal Pigment Epitheliums in Treatment of Macular Degeneration Diseases](#)

## Conclusions You Can Use

While you cannot do anything about your genetic makeup, you can take steps to reduce your likelihood of reaching a stage of age-related macular degeneration that interferes with your central vision. This

involves simple habits that everyone should develop. These include:

- Eat healthy foods
- Lose excess weight
- Take supplements

## References

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- [Double-masked, placebo-controlled, randomized trial of lutein and antioxidant supplementation in the intervention of atrophic age-related macular degeneration: the Veterans LAST study \(Lutein Antioxidant Supplementation Trial\)](#) from the journal *Optometry*
- [Prevention of age-related macular degeneration](#) from the journal *International Ophthalmology*
- [Lutein + zeaxanthin and omega-3 fatty acids for age-related macular degeneration: The Age-Related Eye Disease Study 2 \(AREDS2\) randomized clinical trial](#) from the journal *Ophthalmology*
- [Laser Treatment in Patients with Bilateral Large Drusen The Complications of Age-Related Macular Degeneration Prevention Trial](#) from the journal *Ophthalmology*
- [Dietary  \$\omega\$ -3 Fatty Acid and Fish Intake in the Primary Prevention of Age-Related Macular Degeneration](#) from the journal *Archives of Ophthalmology*
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- [EVALUATION OF CURCUMIN-LOADED NANOLIPOSOMES FOR THE TREATMENT AND PREVENTION OF AGE-RELATED MACULAR DEGENERATION](#) a Thesis submitted in partial fulfillment of the requirements of the Gemstone Program University of Maryland, 2017