

# Nutrition & Age-Related Macular Degeneration (AMD)

Age-related macular degeneration (AMD) is a serious and currently untreatable disease that is the leading cause of acquired blindness among aging Americans. Both the severity and irreversibility of AMD have generated interest in ways to prevent or delay its progression. Nutrition is one promising means of protecting the eyes from AMD.

## Age-Related Macular Degeneration

The macula is the part of the eye responsible for turning light into fine color images in the brain, which allows people to read, drive and perform other daily activities. Though the exact cause of damage to the macula is unknown, a breakdown in the macular area can lead to a loss in people's central vision. Approximately ten million Americans show early signs of AMD and a half million people or more may have significant vision loss from late-stage AMD.

There are several risk factors that we cannot control that may increase the risk of developing AMD. These include: age, family history and light-colored eyes, skin and hair color. Some studies also suggest that women may be at a slightly higher risk than men for developing AMD.

Research also shows that there are several risk factors for AMD that we can control by changing certain behaviors. These preventive actions include: not smoking, reducing exposure to sunlight by wearing UVA/UVB protective eyewear and wide brimmed hats, lowering high blood cholesterol and eating a healthy diet.

## Nutrition Link

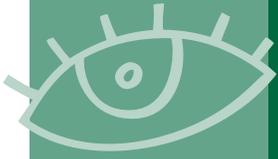
Certain nutrients, such as vitamins C and E, beta-carotene and the mineral zinc, have been found to protect our eyes against AMD and the loss of vision that may result from it. In addition, the carotenoids lutein (pronounced loo-teen) and zeaxanthin (pronounced zee-uh-zan-thin), which are antioxidants and the only carotenoids located in the eye, may also protect our eyes from this disease.

## Research – Antioxidant Vitamins

The Age-Related Eye Disease Study from the National Eye Institute (NEI) is the first large clinical trial to test the effect of a high dose antioxidant vitamin combination plus zinc in preventing or delaying the progression of AMD and the related loss in vision.

The antioxidant vitamins and zinc supplement reduced the risk of developing advanced AMD by about 25 percent in the study subjects who were at high risk for developing the advanced stage of this disease. In the same high-risk group, the supplements also reduced vision loss by 19 percent.





# Nutrition & Age-Related Macular Degeneration (AMD)

The doses tested were:

- 500 milligrams (mg) vitamin C
- 400 IU vitamin E
- 15 mg beta-carotene
- 80 mg zinc
- 2 mg copper (to prevent anemia from high dose zinc)

According to researchers, this supplement combination is the first effective treatment to slow the progression of AMD. The NEI concluded that persons older than 55, with signs of intermediate to late vision loss due to AMD, should consider taking a supplement such as that used in this trial. Effective treatment can delay progression to advanced AMD in about 300,000 people who are at high risk.

## Research – Lutein and Zeaxanthin

The Eye Disease Case Control Study is one of the first large observational studies on carotenoids and AMD that compared diet to the risk of developing AMD. Scientists found that the risk for developing this eye disease was significantly lower in people with high amounts of lutein+zeaxanthin in their blood. Also, those who had higher intakes of lutein+zeaxanthin (5.8 mg per day) had a significantly lower risk for AMD than those who had poor intake of foods with these nutrients (1.2 mg per day). Dietary intake studies have shown similar results, in that frequent consumption of spinach or collard greens, which are particularly good sources of lutein and zeaxanthin, was also associated with a lower risk of developing AMD.

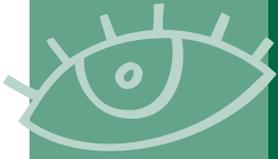
Similarly, a recent analysis of a national dietary intake study called the Third National Health and Nutrition Examination Survey (NHANES III) showed that consuming 6 mg per day of lutein+zeaxanthin from foods was associated with reduced risk for developing AMD.

## What You Need to Know

Given the positive association between nutrition and AMD, it seems prudent for people to obtain higher amounts of certain powerful antioxidants from their daily diet.

Eating five servings of fruits and vegetables each day, as currently recommended by the National Cancer Institute and U.S. Department of Agriculture, can provide more than 100 mg vitamin C and 5 to 6 mg of carotenoids, including lutein and zeaxanthin, and 4.8-6.0 mg beta-carotene (8,000-10,000 IU), given wise choices of fruits and vegetables. Eating two-three servings of meat, shellfish or whole grain cereals can provide 6-10 mg zinc and two servings of nuts and seeds can provide 8-14 mg vitamin E (11.9-20.8 IU) (see tables for good food sources of these nutrients).





# Nutrition & Age-Related Macular Degeneration (AMD)

However, the majority of people in the U.S. are not eating the recommended daily number of servings from most food groups. The average daily diet contains approximately 100 mg vitamin C, 1-7 mg lutein and zeaxanthin, less than 2 mg beta-carotene (3,334 IU), 11 mg of zinc and 8 mg vitamin E (or 12 IU). In the studies mentioned here, the levels associated with benefit were considerably higher than the current average intake. If you find it difficult to increase the level of these nutrients in your diet, multivitamin/mineral and eye health supplements containing these nutrients are available.

## Nutrient Values Tested

Nutrient	Recommended Dietary Allowance (RDA) <sup>1,2</sup>	Levels Associated with Health Benefit	Percent of People Getting Less than 100% of RDA <sup>1,2,3,4</sup>
Vitamin C	90 mg for men 75 mg for women +35 mg for smokers	≥ 250 mg	More than 50% of individuals
Vitamin E*	22 IU (15 mg) natural 33 IU (30 mg) synthetic	≥ 100 IU	More than 90% of individuals
Lutein and Zeaxanthin**	–	6 mg	Average intake per day 1.7 mg
Beta-carotene**	–	15 mg (25,000 IU)	Average intake per day 1.9 mg
Zinc	11 mg for men 8 mg for women	up to 80 mg	Almost 50% of individuals

\* The Food and Nutrition Board reported two different RDA values for vitamin E depending on synthetic or natural source.  
\*\* There is no RDA for lutein, zeaxanthin and beta-carotene.

<sup>1</sup>Dietary Reference Intakes for Vitamin C, Vitamin E and Carotenoids. Institute of Medicine, 2000.

<sup>2</sup>Dietary Reference Intakes for Vitamin A and Zinc. Institute of Medicine, 2001.

<sup>3</sup>Vitamin and mineral data was obtained from CSFII, 1994-1996. Values correspond to all individuals.

<sup>4</sup>Carotenoid data was gathered from NHANES III, 1988-1994.

## Food Sources

Most fruits and vegetables are excellent sources of vitamin C, including oranges, grapefruit, strawberries and papaya, as well as green peppers and tomatoes.

Vitamin E is more difficult to obtain from food sources alone since it is found in very small quantities in foods, such as vegetable oils, nuts and seeds. Good food sources include vegetable oils (including safflower and corn oil), almonds, pecans, wheat germ and sunflower seeds.

Beta-carotene is present mostly in dark green leafy vegetables, deep orange or yellow fruits and vegetables and fortified cereals.

Lutein and zeaxanthin are found together in many food sources. Dark green leafy vegetables are the primary source of lutein and zeaxanthin, but they are also present in lesser amounts in other colorful fruits and vegetables, such as broccoli, orange peppers, corn, peas, persimmons and tangerines.

Good food sources of zinc include meat, liver, shellfish, milk, whole grains and wheat germ.





# Nutrition & Age-Related Macular Degeneration (AMD)

## Good Food Sources of Vitamin C (mg/serving)

Food	Amount	Vitamin C
Orange juice, fresh squeezed	1 cup	124
Grapefruit juice, fresh squeezed	1 cup	94
Papaya	1/2 medium	94
Cantaloupe	1/4 melon	86
Orange	1 medium	80
Green peppers, raw chopped	1/2 cup	67
Tomato juice	1 cup	44
Strawberries	1/2 cup	43
Broccoli, raw chopped	1/2 cup	41
Grapefruit	1/2 medium	40

Source: USDA Nutrient Database for Standard Reference Release 13

## Good Food Sources of Vitamin E (mg/serving)

Food	Amount	Vitamin E
Almonds	1/4 cup	9.3 (13.9 IU)
Sunflower seeds	1/4 cup	5.8 (8.7 IU)
Safflower oil	1 tbsp	4.7 (7.0 IU)
Peanuts	1/4 cup	3.3 (4.9 IU)
Peanut butter	2 tbsp	3.2 (4.8 IU)
Corn oil	1 tbsp	2.8 (4.2 IU)

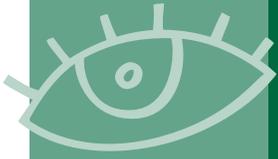
Source: USDA Nutrient Database for Standard Reference Release 13

## Good Food Sources of Zinc (mg/serving)

Food	Serving	Zinc
Oysters, fried	6 medium	76.7
Beef tenderloin	3 ounces	4.8
Chicken leg	3 ounces	2.7
Baked beans	1/2 cup	1.8
Mixed nuts	1 ounce	1.1
Milk	1 cup	1.0
Chicken breast	3 ounces	0.9
Kidney beans	1/2 cup	0.8

Source: Clinical Nutrition Service, Warren Magnuson Grant Clinical Center and Office of Dietary Supplements, National Institutes of Health





# Nutrition & Age-Related Macular Degeneration (AMD)

## Good Food Sources of Lutein and Zeaxanthin (mg/serving)

Food/Serving (1 cup)	Lutein and Zeaxanthin	Lutein	Zeaxanthin
Kale	20.5 - 26.5*	—	1.1 - 2.2*
Collard greens	15.3	—	5.1
Spinach	3.6 - 12.6*	1.7 - 13.3*	0.5 - 5.9*
Turnip greens	12.1	—	0.4
Broccoli	2.1 - 3.5*	1.4 - 1.6*	—
Corn, yellow	1.4 - 3.0	0.6	0.9
Peas, green	2.3	2.2	—
Orange pepper	—	—	1.7
Persimmons	1.4	—	0.8
Tangerine	0.5	—	0.2

\*depending on variety and preparation

Source: USDA-NCC Carotenoid Database, 1998  
USDA Food Nutrient Database for Standard Release 13  
Hart and Scott, 1995

## Beta-Carotene Content of Commonly Consumed Foods (mg)

Food	Serving	Beta-Carotene
Carrot, raw	1 medium (7 1/2")	12.1 (20,170 IU)
Mango	1 whole	4.8 (8,001 IU)
Sweet potatoes	1/2 cup	4.5 (7,501 IU)
Spinach, boiled	1/2 cup	4.4 (7,334 IU)
Cantaloupe	1 cup	3.1 (5,167 IU)
Kale, boiled	1/2 cup	2.9 (4,834 IU)
Apricots, canned	1/2 cup	1.2 (2,000 IU)
Oatmeal, fortified	1 packet	0.6 (1,000 IU)
Ready-to-eat cereal, fortified	1 ounce	0.4 (666 IU)
Peach, raw	1 medium	0.3 (500 IU)

Source: Clinical Nutrition Service, Warren Magnuson Grant Clinical Center and Office of Dietary Supplements, National Institutes of Health

