# Benefits of Antioxidants: May Help Protect Eyes, Lungs and Brain

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There is substantial scientific evidence suggesting that generous intakes of a variety of antioxidant nutrients can help protect vision, lung function, and neurological function, especially in the aging population.

## Cataracts

Vitamin C is 60 times more concentrated in the lens of the eye than in blood plasma, and other antioxidants are also concentrated in the lens. Opacity of the lens of the eye is one of the first signals that cataracts are developing. Cataracts are a major cause of blindness throughout the world, and antioxidants are believed to play a role in protecting against cataracts. Scientists have suggested that the adequate provision of antioxidant vitamins might delay cataract development sufficiently to decrease the number of cataract operations in the United States by one-half. (Taylor 1992)

In the Nutrition and Vision Project (NVP), the development of cataracts (lens opacity) in almost 500 women over the age of 50 was studied in relation to their usual nutrient intake over a period of 13 to15 years prior to the visual exam. The prevalence of lens opacities was lower in women with higher intakes of vitamin C and in women who had used a vitamin C supplement for 10 years or more. "Results from the NVP provide further evidence that antioxidant nutrients are associated with risk of age-related lens opacification. Total vitamin C intake from diet and supplements was associated with a lower prevalence of nuclear opalescence." Vitamin C intake in the lowest quintile was as high as 140 mg per day, which is almost double the RDA for women. Yet the risk of lens opacity decreased in each quintile as vitamin C intake went up to 180, 240, and even 360 mg per day. It has been estimated that tissues in the human eye become saturated with vitamin C at intakes in the range of 200 to 300 mg per day. Vitamin E, lutein and zeaxanthin also had protective effects, but these were not clearly independent of the vitamin C effect, since women with a high vitamin C intake tended to have higher intakes of the other nutrients as well. (Jacques 2001)

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Among residents of Beaver Dam, Wisconsin, the risk of developing a cataract over a period of five years was 60 percent lower in people who had used multivitamins or a supplement containing vitamin C or vitamin E for more than 10 years, compared to people who did not use such supplements. Use of supplements for a shorter period of time did not appear to have a protective effect. "Measured differences in lifestyle between supplement users and non-users did not influence these associations, nor did variations in diet as measured in a random subsample." (Mares-Perlman 2000)

The National Eye Institute supported a Longitudinal Study of Cataract involving 764 participants whose eyes were examined yearly over a period of about five years. The average age of the subjects was 65. Participants who were regular users of multivitamin supplements or vitamin E supplements were less likely to have an increase in lens opacity during the study period. (Leske 1998)

In a study of nurses in Boston, researchers found that women who used vitamin C supplements for at least ten years had a 77 percent lower risk of developing early lens opacities, compared to women who did not use vitamin C supplements. The authors suggested that "long-term consumption of high amounts of vitamin C (in the present case primarily through dietary supplements) may substantially reduce the development of age-related lens opacities." (Jacques 1997)

During the first five years of the Physicians' Health Study, involving over 22,000 doctors, 370 cataracts developed and there were 109 cataract operations. Researchers from Harvard Medical School found that doctors who used multivitamins had a 27 percent lower risk of developing a cataract and a 21 percent lower risk of having a cataract operation, compared to doctors who did not use supplements. (Seddon 1994)

## Age-Related Macular Degeneration (AMD or ARMD)

"Age-related macular degeneration (ARMD) is the leading cause of blindness in people over the age of 65 in Western countries. It has been estimated that 13 million people in the United States have evidence of ARMD and that the disease causes visual impairment in 1.2 million." About 30 percent of people over 75 suffer from this condition, for which there is no treatment. (Pratt 1999)

The macula is the part of the retina that is responsible for central vision and visual acuity. In primates, including humans, the central area of the macula is yellow, due to presence of the "macular pigment," a high concentration of the carotenoids lutein and zeaxanthin. Age-related macular degeneration (AMD) occurs in about 20 percent of the population above the age of 65. It is irreversible and is the leading cause of visual impairment in the United States. Humans cannot synthesize carotenoids, but are dependent on dietary sources. Supplementation with lutein has been found to increase serum levels of this nutrient and also to increase macular pigmentation. (Landrum 1997)

It appears that one modifiable risk factor for AMD is a low intake of fruits and vegetables rich in carotenoids. It is hypothesized that the macular pigment protects the retina by

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filtering damaging sunlight and by providing antioxidants to protect the retina from damage caused by light-induced free radicals. Epidemiologic studies confirm that people who consume a high level of fruits and vegetables containing carotenoids have a lower risk of AMD. (Pratt 1999)

In a recent study, researchers evaluated the density of the macular pigment and visual sensitivity in people over 60 and in younger subjects (aged 24 to 36 years). Older people with a high macular pigment density had visual sensitivity comparable to younger adults. Older people with a lower density of the macular pigment had lower visual sensitivity. It has been shown that losses in visual sensitivity "precede and predict the development of retinal diseases such as AMD." The researchers suggested that people with low macular pigment density should be vigorously discouraged from smoking and should be encouraged to increase their intake of fruits and vegetables rich in carotenoids. (Hammond 1998)

The Age-Related Eye Disease Study (AREDS) is an 11-year multicenter trial involving more than 3600 people who had evidence of Age-Related Macular Degeneration when they entered the trial. Participants were assigned to one of four groups, with each group receiving antioxidant supplements, zinc supplements, both or a placebo. The antioxidant supplement included 500 mg vitamin C, 400 IU vitamin E and 15 mg beta-carotene. The zinc supplement included 80 mg zinc and 2 mg copper. The participants that received both the antioxidant and the zinc supplements were significantly protected from development of advanced AMD. The researchers suggested that people over the age of 55 should have an eye exam including dilation of the eyes to evaluate their risk of developing advanced AMD. People at risk of AMD "should consider taking a supplement of antioxidants plus zinc such as that used in this study." However, the authors noted that supplementation with beta-carotene is not advised for smokers. (AREDS 2001)

In the United States, AMD is "the leading cause of new cases of legal blindness and no treatment is available for most patients. If macular vision is degraded, the ability to read, drive a car, and even recognize familiar faces can be lost." The effect on the quality of life of elderly people is severe, so there is "high motivation to prevent this condition." Antioxidant nutrients, especially carotenoids, have been associated with a reduced risk of developing AMD. Stopping smoking, consuming generous amounts of fruits and vegetables, and avoiding excessive exposure to sunlight are lifestyle factors that can reduce the risk of AMD. (Snodderly 1995)

## Antioxidants and the Lungs

"Reduced pulmonary function is an important predictor of mortality in the general population." Factors that affect pulmonary function are not completely understood, but exposure to excessive oxidation is believed to have a damaging effect. "Vitamin C and vitamin E are powerful antioxidants found in the lung where they protect against oxidative damage. Although vitamin E is predominantly membrane bound, there is a close interaction between vitamins C and E, because vitamin C not only functions

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directly as an antioxidant, but it also recycles the antioxidant capacity of oxidized vitamin E." Vitamin A and the carotenoids also have anti-inflammatory and antioxidant activity and play a role. "These compounds have been thought to protect against development of lung cancer and other respiratory illnesses." In a study of over 1600 adults in western New York state, researchers examined the association between serum levels of these vitamins and lung function. Lung function was found to improve as blood levels of the antioxidant vitamins increased, with the strongest impact being associated with vitamin E and beta-cryptoxanthin. (Schunemann 2001)

In a British study of lung function in 178 men and women 70 to 96 years of age who had respiratory symptoms, researchers found that for every extra milligram of vitamin E in the diet, there was an improvement in performance on two tests of lung function. (Dow 1996) In another study of more than 2600 people in the area of Nottingham, England, higher dietary intakes of vitamin C and vitamin E were associated with improved lung function. (Britton 1995)

Exposure to ozone can cause inflammation in the lung and potentially damage it. In a study involving 31 healthy adults, researchers gave the participants 250 mg of vitamin C, 50 IU of vitamin E, 12 ounces of a vegetable cocktail or a placebo for a period of two weeks. For the two weeks of the study and the week before it started, the participants followed a vitamin C-restricted diet. The subjects were then exposed to ozone for a period of two hours and lung function was tested. The ozone caused an inflammatory response in all the groups, but the people supplemented with antioxidants had less damage to lung function, compared to the placebo group. This study suggests that antioxidant supplementation may be "a safe and effective strategy with which to decrease pulmonary function responses to this common air pollutant." (Samet 2001)

## Nutrition and Brain Function

In a longterm study of more than 3000 Japanese-American men over 70 years of age living in Hawaii, researchers found that the use of vitamin C and vitamin E supplements significantly reduced the risk of dementia. In those without dementia, use of vitamin C or vitamin E supplements was associated with improved cognitive function. (Masaki 2000)

In a longitudinal study of aging, researchers from the University of New Mexico School of Medicine measured cognitive function in 137 people aged 66 to 90. Higher intakes of vitamin C, thiamin, riboflavin, niacin and folate were correlated with better performance on various tests of cognitive performance. "Use of self-selected vitamin supplements was associated with better performance on a difficult visuospatial test and an abstraction test." (La Rue 1997)

"Although severe vitamin deficiencies and congenital defects are rare, milder subclinical vitamin deficiencies are not uncommon in the elderly. Interest is increasing in learning the extent to which these mild, reversible deficiencies contribute to some decline in cognitive function in the later years of life." It is well established that deficiencies of the

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B vitamins involved in the single-carbon cycle have severe effects on brain function that can result in depression, dementia, and other disorders. Results of some studies "support the possibility that poor vitamin status is partially responsible for the cognitive decline seen in some elderly persons." (Selhub 2000)

In a study in Newfoundland, supplementation of apparently healthy men and women over the age of 65 for a period of one year improved cognitive function as measured by tests of short-term memory, abstract thinking, problem-solving ability, and attention. The supplement given was a modest multivitamin with minerals. The author of the study, Dr. Ranjit Chandra of the Memorial University of Newfoundland, concluded, "Given the high frequency of nutrient deficiencies in old age, it would be prudent to opt for a suitable micronutrient supplement for all elderly subjects to achieve the maximum physiologic and health benefits with the least risk of toxicity." He added that such a supplement "might significantly delay or prevent the onset of overt Alzheimer's disease." (Chandra 2001)

According to the authors of a study on Alzheimer's disease, "there is evidence that medications or vitamins that increase the levels of brain catecholamines and protect against oxidative damage may reduce the neuronal damage and slow the progression of Alzheimer's disease." They conducted a randomized, double-blind, multicenter study involving 341 patients. During the two-year study, patients received a monoamine oxidase inhibitor called selegiline, 2000 IU per day of vitamin E, both treatments, or a placebo. The researchers reported that treatment with vitamin E or with selegiline delayed progression of the disease, including "delays in the deterioration of the performance of activities of daily living and the need for care." (Sano 1997)

There is evidence to suggest that oxidative stress plays a role in the development of Alzheimer's disease, and there is clear evidence of oxidative damage in the brains of patients with the disease. A clinical trial of vitamin E and selegiline in patients with moderate Alzheimer's disease showed that these treatments slowed the rate of functional decline to a significant degree. The results raise the question whether vitamin E might also delay the decline in patients with milder cases of Alzheimer's disease, "and whether it may prevent dementia in elderly individuals who are minimally or not yet cognitively impaired." The Alzheimer's Disease Cooperative Study has initiated an additional trial to determine whether vitamin E can prevent or delay development of Alzheimer's disease in patients with mild cognitive impairment. (Grundman 2000)

Parkinson's disease affects about 3 percent of the population over 65 years of age. While the causes are not known, it is recognized that the neurons "are constantly exposed to external and internal toxins in the brain," and many of these neurotoxins produce free radicals that can cause oxidative damage. "Antioxidant defense systems represented by antioxidant enzymes, synthesized antioxidants and dietary antioxidants can quench these radicals; however, if excessive numbers of free radicals are produced or endogenous antioxidant levels are reduced, damage to neurons can occur." While clinical trials continue, Dr. Kedar Prasad of the Colorado Health Science Center suggests that supplementation with a number of antioxidants might be advisable for people at high risk

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of Parkinson's disease. He recommends that the formula should include 5000 IU vitamin A, 15 mg natural beta-carotene, 200 IU vitamin E, 500 mg vitamin C, 400 IU vitamin D, two or three times the RDA of all the B vitamins, 100 μg selenium, 50 μg chromium, and 15 mg zinc. He specifies that the product should not contain iron, copper or manganese. Higher levels of these nutrients or additional supplements are suggested as being appropriate for people in the early stages of Parkinson's disease or in conjunction with therapy in persons being treated with L-Dopa and/or selegiline. (Prasad 1999)

## Bottom Line

Scientific research and epidemiological studies involving antioxidants suggest a multitude of potential benefits. Though the strength of the evidence varies from one disease condition to another, there is reason to believe that antioxidant supplements can play an important role in protecting eyesight, pulmonary health, and brain function.

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