Nutritional Influences on Illness
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Cataracts: Vitamin C, Vitamin E, and the Carotenoids

With its continual exposure to light and ambient oxygen, the optical lens is at high risk of photooxidative damage. Oxygen free radicals cause cataracts by oxidizing the lens proteins while also impairing the proteolytic enzymes designed to eliminate the damaged proteins. Normal lenses of older people only show early evidence of oxidation that is confined to the intrinsic membrane fraction and membrane-related components; the development of cataract is associated with progressive oxidative changes in these components, which eventually extend beyond them to involve the soluble components of the lens proteins. Since vitamins C and E, as well as the carotenoids lutein and zeaxanthin, are present in human lenses, and since all can reduce oxidative stress, we will examine the current evidence suggesting that supplementing them may combat the progression of age-related cataracts.

Vitamin C

The concentration of ascorbic acid in the aqueous humor is among the highest of all the body fluids, and there is substantial evidence that vitamin C nutrure has a significant effect on cataract formation. When, for example, rat lenses were maintained in a solution designed to cause free radical damage, the addition of vitamin C protected them. As to humans, the intake of vitamin C supplements over at least the past decade has repeatedly been found to be inversely correlated with cataract risk. Even over only a five-year period, a higher vitamin C intake has been repeatedly associated with a reduced incidence of cataracts.

Also, a study of Italian-Americans found that higher plasma levels of vitamin C were associated with a decreased risk of cataract, and blood levels of the vitamin in a Mediterranean population were inversely correlated with the risk of cataract. Moreover, researchers examining cataractous human lens nuclei found an inverse relationship between vitamin C concentration in the lens and cataract severity.

In two open trials performed in the 1930s, 60% to 90% of patients with incipient senile cataracts had visual improvement following supplementation with the vitamin, improvement that was sometimes marked. Findings
Nutritional Influences on Illness

from a more recent randomized trial, however, were far less dramatic. A large population of rural Chinese aged 45 to 74 years received either vitamin C 120 mg daily, along with 30 mcg molybdenum, or placebo daily. After five years, there was a nonsignificant reduction of 22% in cataract risk.12

Vitamin E

Like vitamin C, the addition of vitamin E protected rat lenses from free radical damage when they were immersed in a solution designed to cause such damage.13 In addition, when added to the perfusion solution, vitamin E doubled the survival time of isolated rabbit corneal endothelium.14 For humans, long-term vitamin E intake has been inversely related to the risk of cataract.15-16 The same relationship has been noted in regard to serum levels of the vitamin.17 Moreover, a recent longitudinal study found that, in both regular users of vitamin E supplements and persons with higher plasma levels of vitamin E, the risk of nuclear opacification was reduced by approximately half.18

Despite these promising findings, two randomized trials have failed to find evidence of the vitamin's efficacy. One trial was of 1193 volunteers aged 55-80 years with early or no cataract. They received either 500 IU vitamin E daily or placebo and were followed for four years. Supplementation failed to reduce the incidence or progression of nuclear, cortical, or posterior subcapsular cataracts.19

A larger trial involved 39,876 females aged 45 years or older. They received either 600 IU of natural-source vitamin E on alternate days, or placebo. After almost ten years of treatment and follow-up, there was no evidence that supplementation reduced the incidence of age-related cataract.20

Carotenoids

The intake of carotenoids – particularly alpha- and beta-carotene, lutein, lycopene, and zeaxanthin – has been inversely correlated with cataract risk.21-24 Although two epidemiological studies failed to find a relationship between beta-carotene intake and the risk of cataract,22,23 another found that the prevalence of posterior subcapsular lens opacities in women who never smoked was related to the intake of alpha- and beta-carotene as well as with total carotenoids.1 Also, the blood level of beta-carotene has been inversely correlated with cataract risk.25 In fact, one study found that those with serum levels of beta-carotene in the lowest third of the distribution had almost a threefold risk of senile cataract.26

Combined Supplementation

In a randomized trial, patients in Europe and America with early age-related cataracts received either vitamin C 750 mg, vitamin E 600 IU, and beta-carotene 18 mg, or placebo. After two years, there was a small positive treatment effect in American patients; after three years, the positive effect was apparent in the total group, with an even greater effect in the American group. By contrast, there was no significant effect in the European group.27

Other similar trials have failed to show any significant benefits. In a randomized trial of Americans, participants aged 55-80 years received daily tablets of either vitamin C 500 mg, vitamin E 400 IU, and beta-carotene 15 mg, or no antioxidants. After an average of 6.3 years, there was no significant effect of the formula on the development or progression of age-related lens opacities.28 Similarly, residents of South India aged 35-50 years (as this population has early progression of cataracts) received vitamin C 400 mg, vitamin E (RRR-alpha-tocopherol) 400 IU, and 15 mg beta-carotene from algae in the all-trans form with small amounts of other carotenoids. After five years, supplementation failed to affect cataract progression.29 Thus, findings from randomized trials have so far failed to live up to the high expectations raised by other studies.
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