Use of Antioxidant Vitamins and Minerals in Age-Related Eye Diseases

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Age-Related Eye Diseases

Cataract

AMD
Cortical Cataract
Advanced AMD

Neovascular AMD or Central Geographic Atrophy
Importance of potential prevention
age-related cataract & macular degeneration
with vitamins/mineral

Cataract Surgery
• highly successful, huge expense

Age-related macular degeneration
• lack of successful treatment for the majority of cases (atrophic)
Rationale for use of vitamins in age-related cataract & macular degeneration

Oxidative stress

• generated through photo oxidation and metabolic processes

• results in reactive oxygen intermediates: free radicals, hydrogen peroxide, or singlet oxygen
Rationale for use of vitamins in age-related cataract & macular degeneration

• Data from animal models, in vitro experiments
• Observational human data
• Controlled clinical trials
Studies of Cataract and Nutrition

Observational studies

• Cross-sectional studies
• Case-control studies

Controlled clinical trials
Cataract: Observational Studies

Cross-Sectional Studies

Baltimore Longitudinal Study on Aging
Nutritional Factors in Eye Disease Study
Beaver Dam Eye Study

Inconsistent associations with vitamins
Cataract: Observational Studies

Case-Control Studies of Vitamin Use

India-US Case Control Study of Cataract

Plasma antioxidant index (protective)

Lens Opacities Case-Control Study

Dietary C, E, and carotene (protective)

Italian American Cataract Study

No association with serum or diet
Cataract

Randomized Controlled Clinical Trials

Linxian Study, China
ATBC Cancer Prevention Trial, Finland
VECAT, Australia
Physicians’ Health Study, U.S.A
Linxian Study: Cataract

- NIH-sponsored trial for esophageal cancer
- nutritionally deprived population

Results:
- beneficial effect for nuclear cataract
- 5-6 years of multivitamin/mineral and riboflavin/niacin
Alpha-Tocopherol and Beta Carotene Trial
Cataract

• NIH-sponsored trial for lung cancer
• heavy male smokers (N=29, 133)

Results:

• **NO** beneficial effect for cataract
• 6.6 years of vitamin E and beta-carotene
VECAT Study

Australian Study of AMD & cataract

- 400 IU vitamin E vs. placebo
- four years of follow-up
- 1204 participants
- 55 to 80 years of age
VECAT Study

Results: Age-related cataract

**NO** evidence of beneficial effects following 4 years of vitamin E supplementation
VECAT Study Results

For age-related macular degeneration:

No evidence of beneficial effects following four years of vitamin E supplementation
Physicians Health Study

U.S. Study of AMD & cataract

• 50 mg beta-carotene vs. placebo every other day
• followed for 12 years
• 22,071 male physicians
• 40 to 80 years of age
Physicians Health Study

Results of age-related cataract

• 998 cataracts in beta-carotene group
• 1,019 cataracts in placebo group

OR: 0.98, 95% CI: 0.9 1.08

• **NO** beneficial effects of beta-carotene
Studies of AMD and Nutrition

Observational studies

• Cross-sectional studies
• Case-control studies

Controlled clinical trials
AMD: Observational Studies

Cross-Sectional Studies

Baltimore Longitudinal Study on Aging
Blue Mountains Eye Study
Beaver Dam Eye Study

Inconsistent associations with vitamins
AMD: Observational Studies

An Analysis from the National Health and Nutritional Examination Survey (NHANES I)

Consumption of fruits and vegetables Rich in Vitamins A & C

Protective of AMD by 41%

OR = 0.59 95% CI: 0.37, 0.99
AMD: Case-control Study

Eye Disease Case Control Study (EDCCS)

421 cases of neovascular AMD, 615 controls

Blood levels of vitamins/minerals:
  • carotenoid
  • vitamins C, E,
  • selenium
  • zinc
**AMD: Case-control Study**

Eye Disease Case Control Study (EDCCS)

Carotenoids decreased the risk of AMD

<table>
<thead>
<tr>
<th>Level</th>
<th>OR</th>
<th>95% CI</th>
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<tbody>
<tr>
<td>Low</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>0.5</td>
<td>(0.4, 0.8)</td>
</tr>
<tr>
<td>High</td>
<td>0.3</td>
<td>(0.2, 0.6)</td>
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AMD: Case-control Study

Eye Disease Case Control Study (EDCCS)

High dietary intake of carotenoids reduced the risk of AMD by 43%

<table>
<thead>
<tr>
<th></th>
<th>OR</th>
<th></th>
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<tbody>
<tr>
<td>Low</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>0.57</td>
<td>(0.35, 0.92)</td>
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</table>
AMD: Case-control Study

Eye Disease Case Control Study (EDCCS)

Carotenoids-Dietary:

- Lutein
- Zeaxanthin
AMD: Case-control Study

Eye Disease Case Control Study (EDCCS)

Source of lutein and zeaxanthin:

Spinach

Collard greens
## AMD: Case-control Study

### Eye Disease Case Control Study (EDCCS)

**Frequency of spinach & collard greens:**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>OR</th>
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<tbody>
<tr>
<td>&lt; 1/month</td>
<td>1</td>
</tr>
<tr>
<td>2-3 month</td>
<td>0.81</td>
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<tr>
<td>1/week</td>
<td>0.61</td>
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<tr>
<td>2-4/week</td>
<td>0.54</td>
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<tr>
<td>5-6/week</td>
<td>0.14</td>
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</table>
Section through Fovea of Rhesus Monkey (Macaca Mulatta)

Macula Lutea

Macular Pigment Viewed in White Light

© Max Snodderly, 2002
Lutein

- antioxidant vitamin
- 1 of 600 carotenoids that occur in nature
- 1 of 14 major dietary carotenoids found in the human plasma
- usually associated with zeaxanthin
Lutein

• major filter of ultraviolet radiation
• major component of the yellow pigment of the macula
• a sunscreen in plants
Lutein

Possible treatment for

Age-related macular degeneration?
Lutein

• evidence NOT in for beneficial effects

• observational data only

• potential for confounding