

Beyond Carrots - Nutritional & Integrative Strategies for Age-Related Eye Diseases



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Sinai

World Health Organization (WHO)



- Globally, at least 2.2 billion people have vision impairment or blindness.
- In at least 1 billion, vision impairment could be avoided or prevented.

Leading Causes of Vision Impairment and Blindness:

- refractive errors
- cataract
- diabetic retinopathy
- glaucoma
- age-related macular degeneration (AMD)



Causes of Vision Impairment That Can Be *Prevented* and/or *Ameliorated* by Nutrition & Lifestyle

- refractive errors
- cataract
- diabetic retinopathy
- glaucoma
- age-related macular degeneration (AMD)



What Is The Most Important Food For Eye Health?



Nutrition for Specific Eye Conditions



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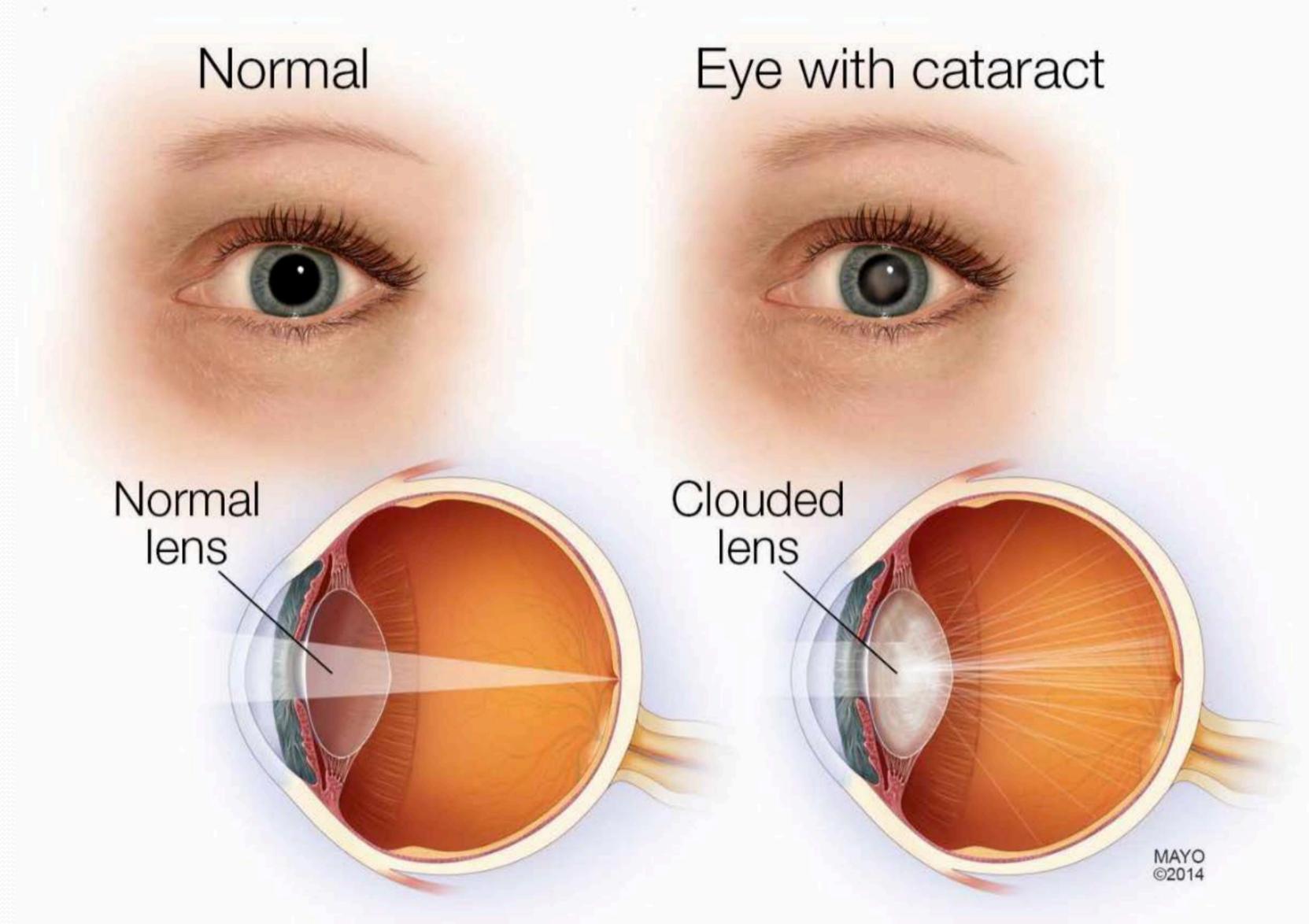
Cataract



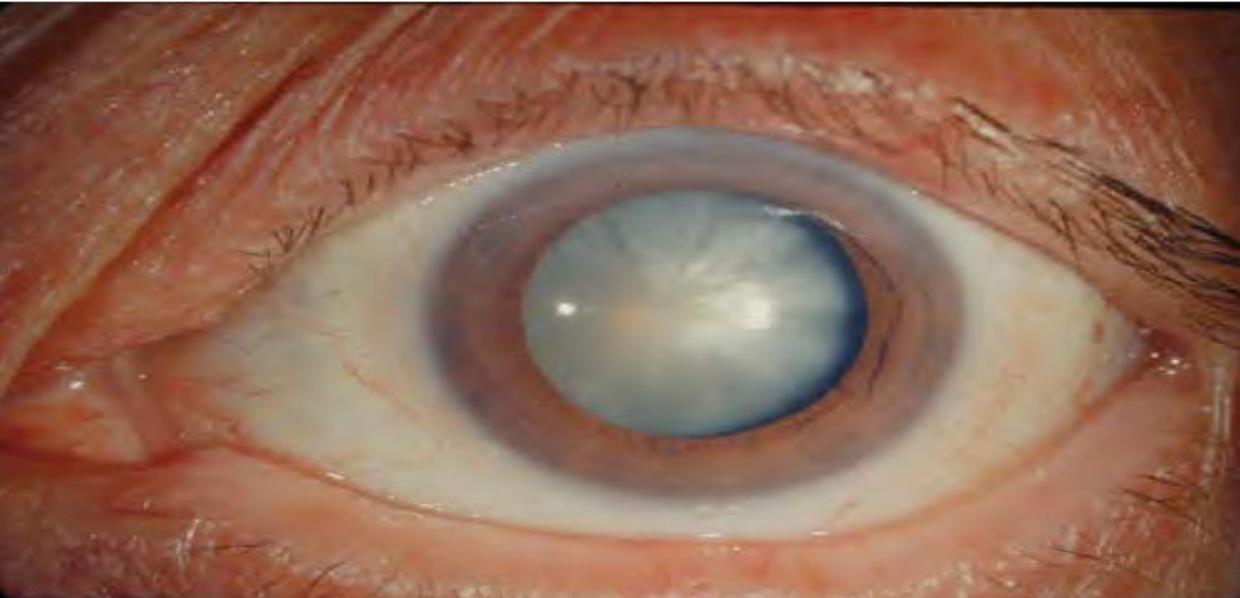
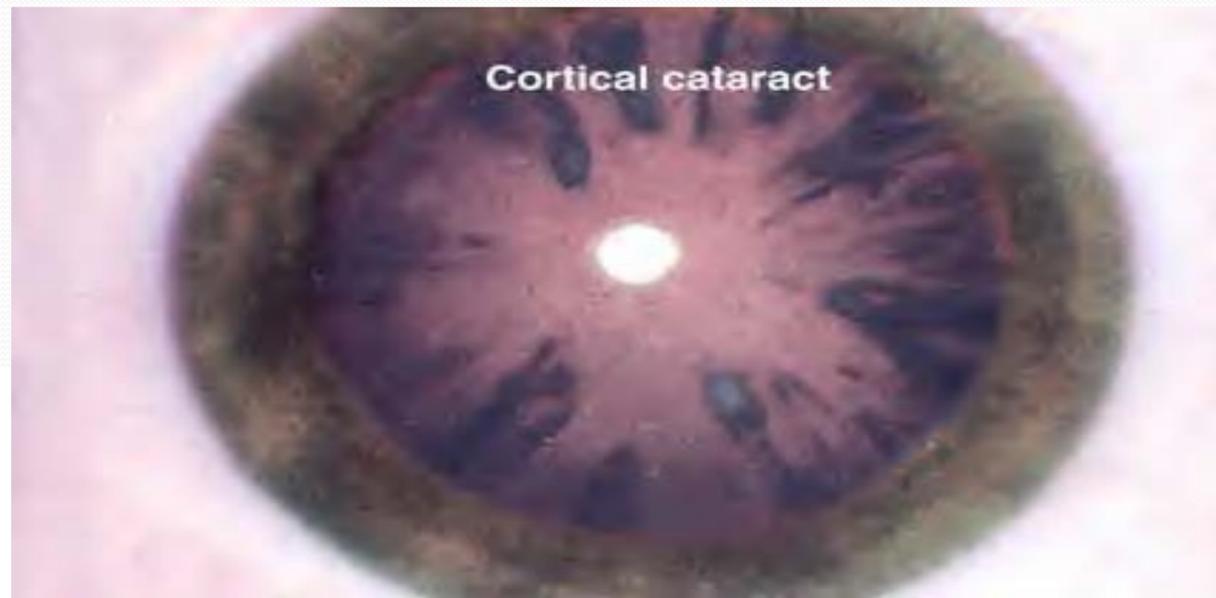
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What is a cataract?

- Natural lens is clear and transparent
- With increasing age, lens becomes yellow and cloudy
- Decreases vision



Cataracts



Cataract- Symptoms

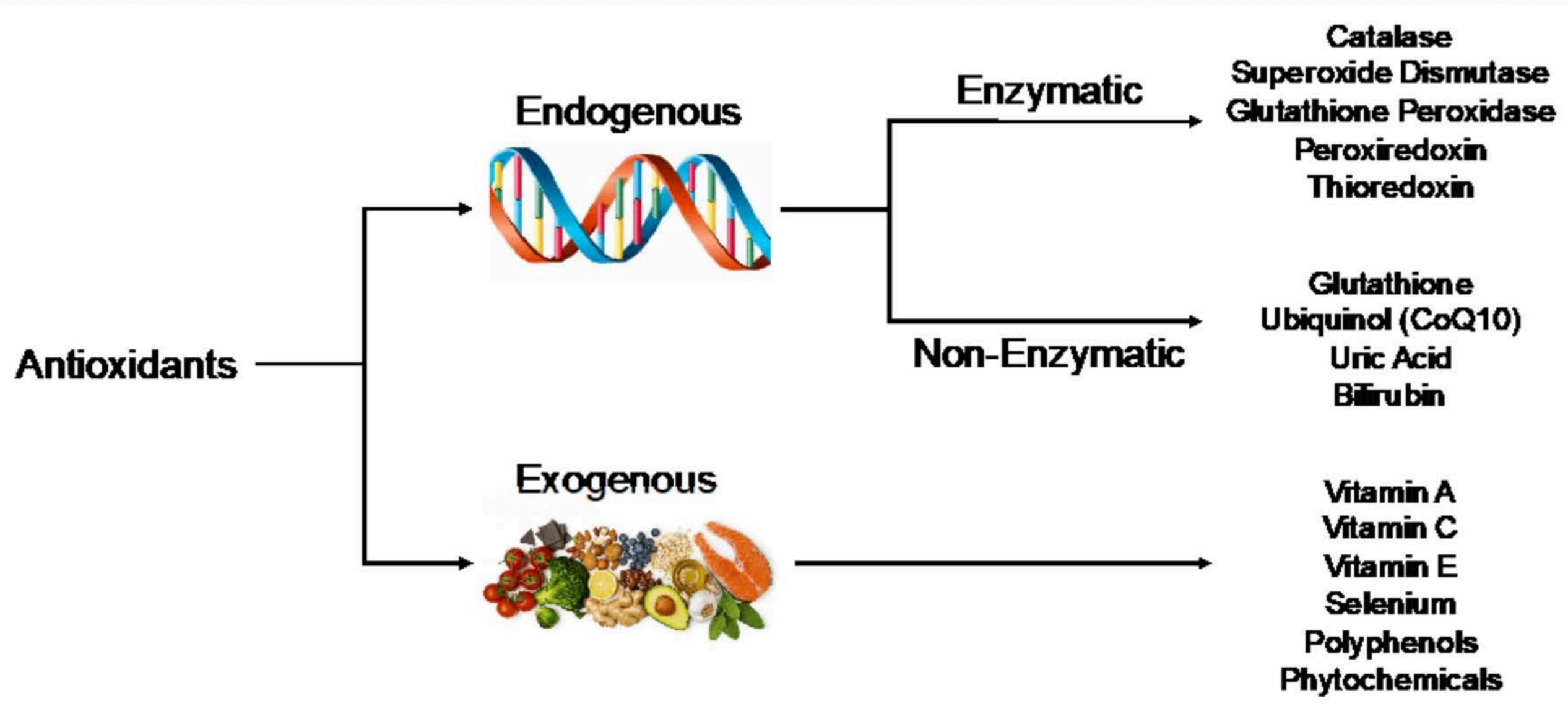


How Can Cataracts Be Prevented?

- Decrease oxidative stress
- Increase endogenous antioxidant production
- Provide exogenous antioxidants



Anti-Oxidants Used by Body



Exogenous Anti-Oxidants

- Carotenoids
 - beta carotene
 - macular carotenoids
- Alpha lipoic acid
- N-acetyl cysteine
- Bioflavonoids



Review > [Nutrients](#). 2023 Oct 28;15(21):4585. doi: 10.3390/nu15214585.

Influence of Diet, Dietary Products and Vitamins on Age-Related Cataract Incidence: A Systematic Review

Martyna Falkowska ¹, Maryla Młynarczyk ², Zuzanna Micun ², Joanna Konopińska ²,
Katarzyna Socha ¹

Review > [Proc Nutr Soc](#). 2022 May;81(2):190-198. doi: 10.1017/S0029665121003748.

Epub 2021 Oct 27.

Plant-based diets and long-term health: findings from the EPIC-Oxford study

Timothy J Key ¹, Keren Papier ¹, Tammy Y N Tong ¹

Affiliations + expand

PMID: 35934687 PMCID: [PMC7613518](#) DOI: [10.1017/S0029665121003748](#)





Preventative measures for cataracts:

Macular carotenoids- Lutein, Zeaxanthin

Associations between age-related nuclear cataract and lutein and zeaxanthin in the diet and serum in the Carotenoids in Age-Related Eye Disease Study (CAREDS), an ancillary study of the Women's Health Initiative

Suzen M. Moeller, PhD, Rick Volland, PhD, Lesley Tinker, PhD, Barbara A. Blodi, MD, Michael L. Klein, MD, Karen M. Gehrs, MD, Elizabeth J. Johnson, PhD, D. Max Snodderly, PhD, Robert B. Wallace, MD, Richard J. Chappell, PhD, Niyati Parekh, RD, PhD, Cheryl Ritenbaugh, PhD, Julie A. Mares, PhD, and the CAREDS Study Group

Dark green leafy vegetables



Kale



Arugula



Spinach



Broccoli



Swiss Chard



Collard Greens



Romaine Lettuce



Mustard Greens



Dandelion Greens



Bok Choy



Other preventative measures for cataracts:

- 100% UVA/UVB protection when outdoors in sun



RESEARCH ARTICLE

Relationship between practices of eye protection against solar ultraviolet radiation and cataract in a rural area

Li-Ju Chen^{1,2,3*}, Yun-Jau Chang^{4,5*}, Chun-Fu Shieh⁶, Jy-Haw Yu¹, Ming-Chin Yang^{3*}



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Macular Degeneration

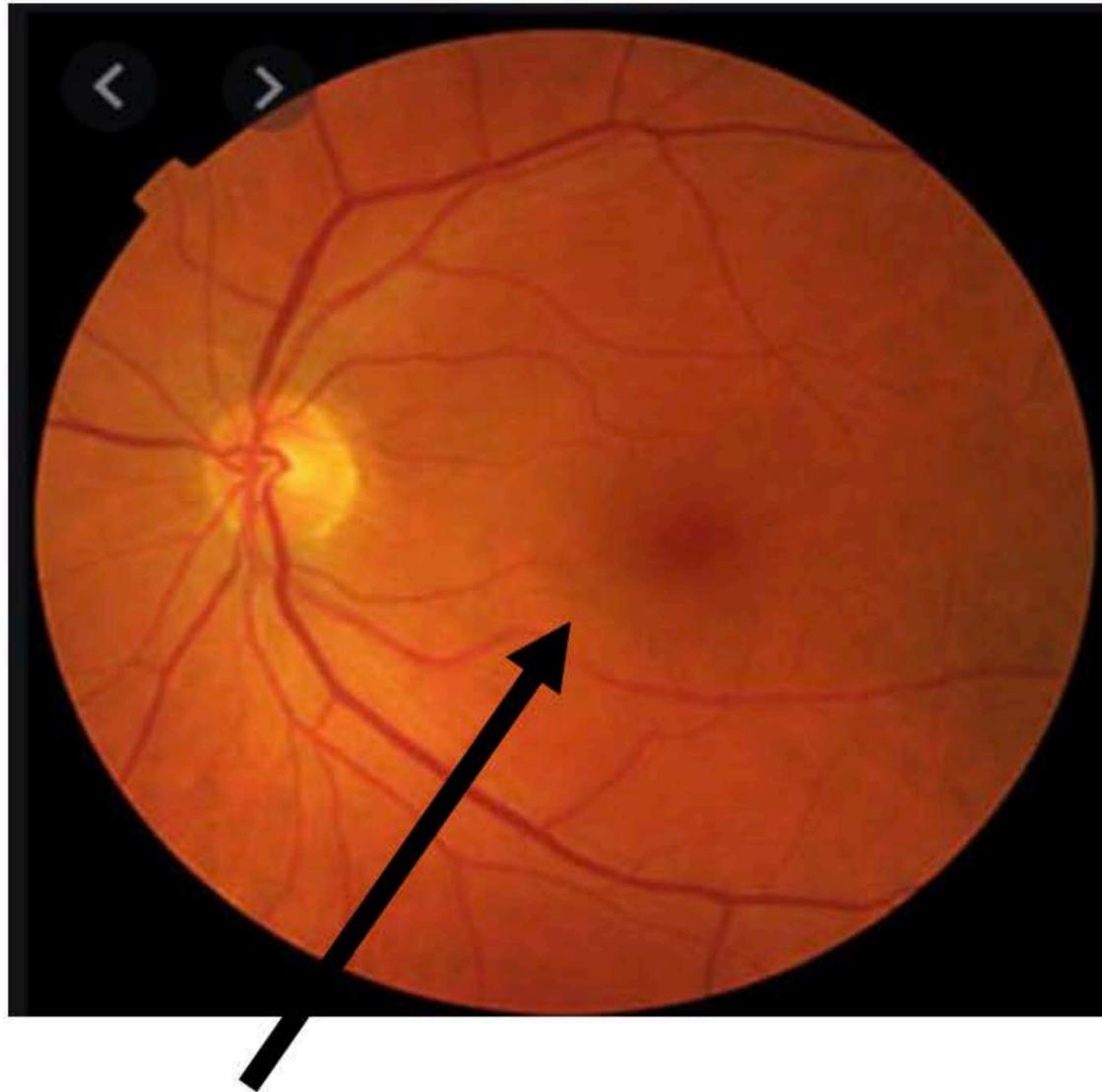


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Macular Degeneration (AMD)



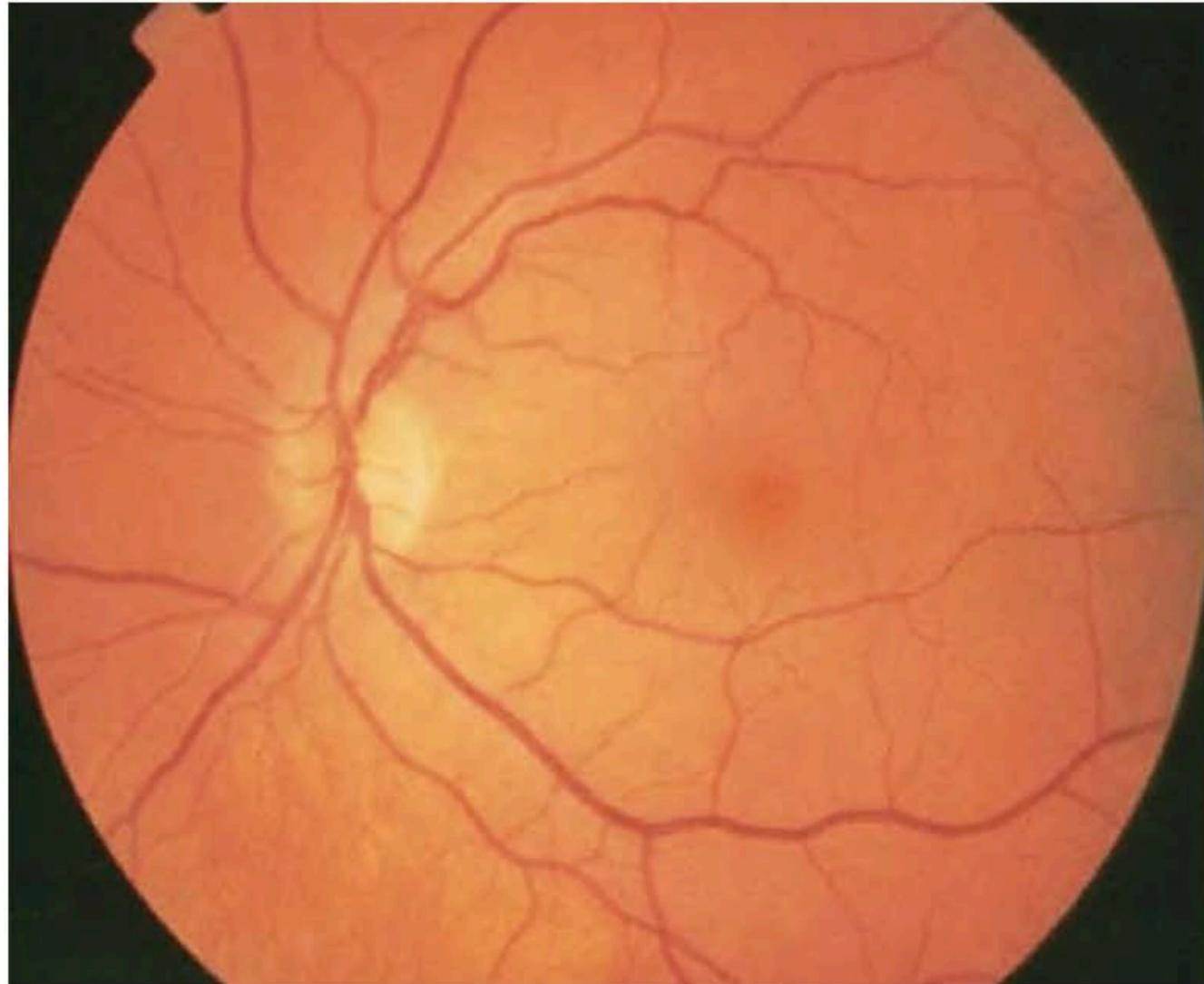
- Leading cause of vision loss In individual > 65 yrs
- ~ 20 million Americans affected
- More than the number pf people with Alzheimer's and Parkinson's disease COMBINED!



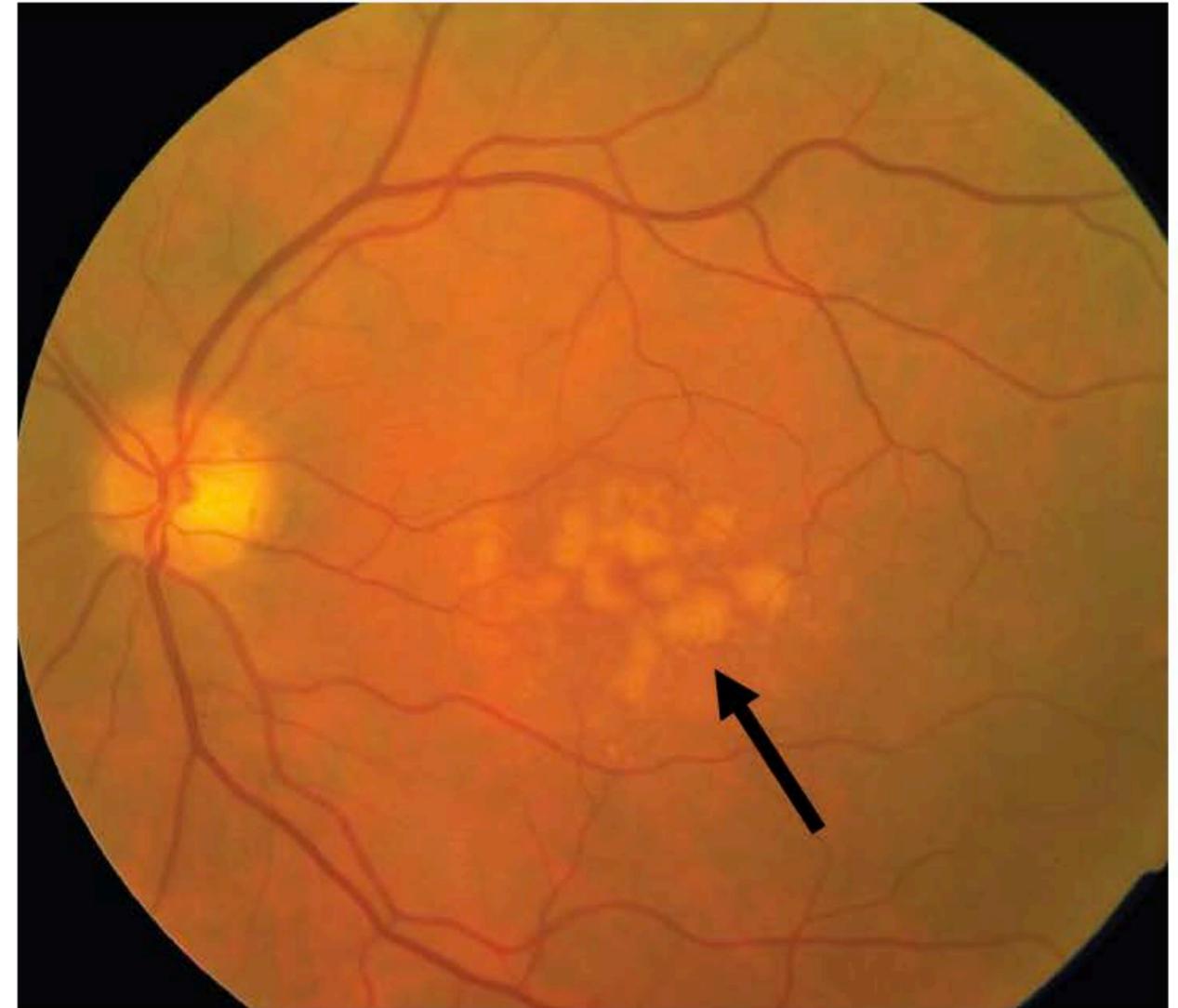
Macula at the center of retina



Bull's eye with arrow at center



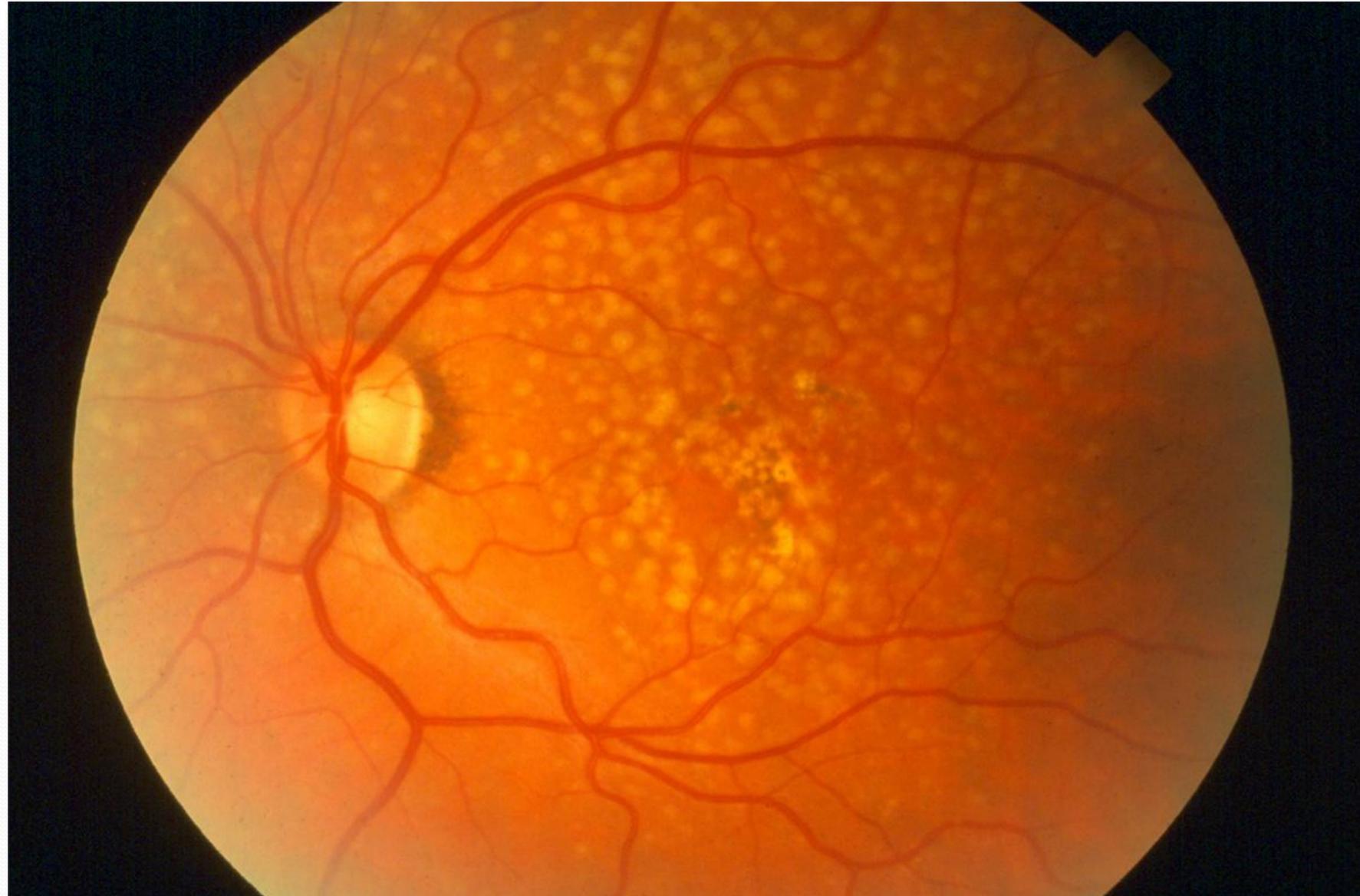
Normal



Dry ARMD
Deposits: drusen
Gradual visual loss

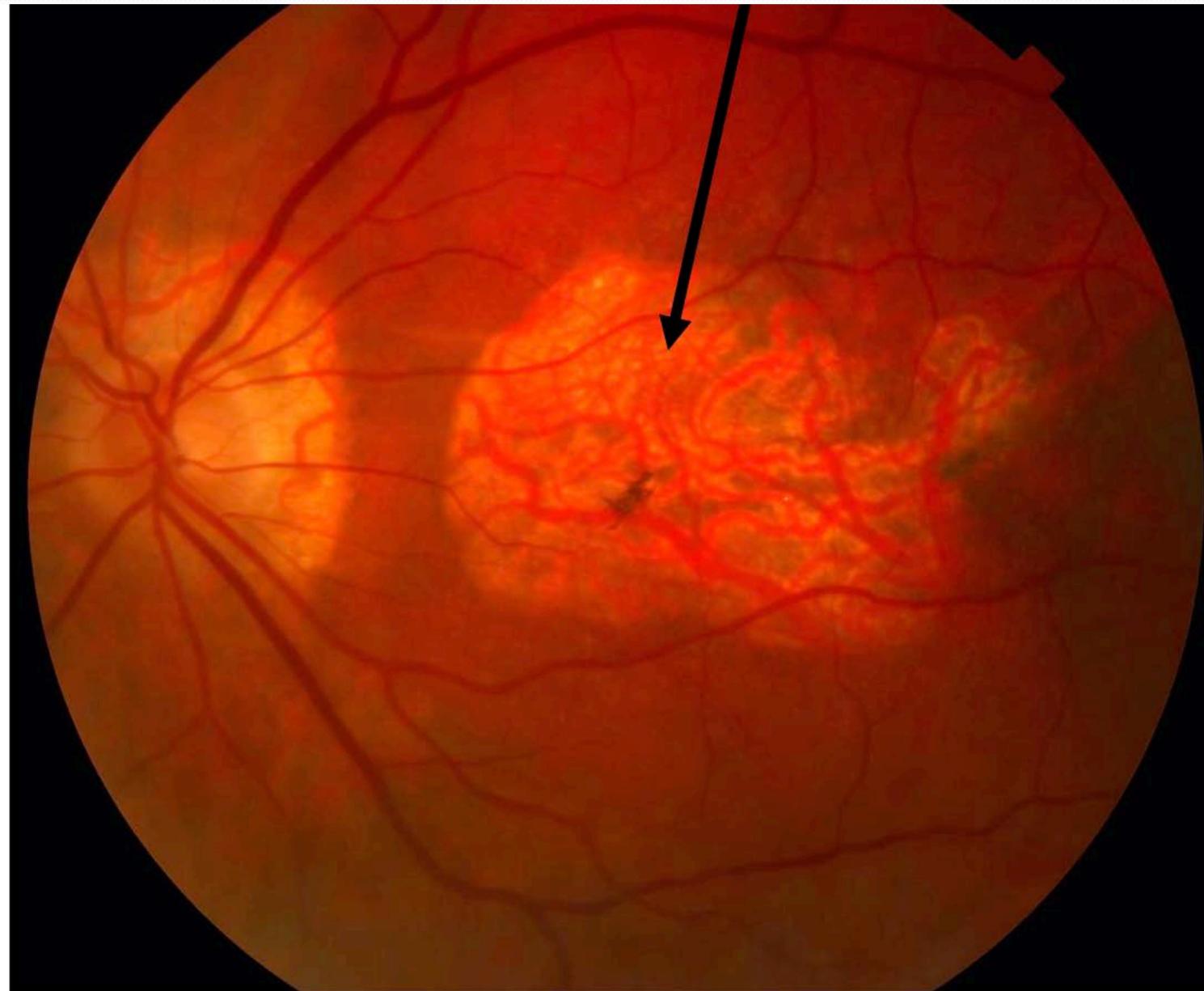
Intermediate Dry AMD

No



Advanced Dry AMD

"Geographic Atrophy" or "GA"



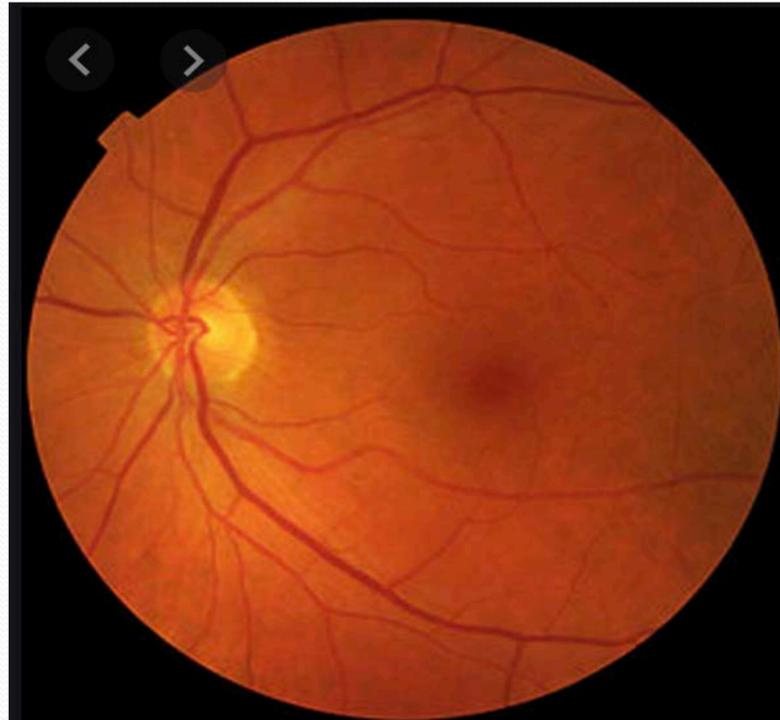
Advanced Wet Macular Degeneration = “Leaky Eye Syndrome”



- Sudden, severe visual loss
- Bleeding under the retina
- Accumulation of blood and fluid decreases central vision

"Leaky Eye" Syndrome

Healthy retina



Dry Macular Degeneration



Wet Macular Degeneration



Age-Related Macular Degeneration (AMD)



Metamorphopsia =
Distortion or
“Waviness of vision”



Article

November 9, 1994

Dietary Carotenoids, Vitamins A, C, and E, and Advanced Age-Related Macular Degeneration

Johanna M. Seddon, MD; Umed A. Ajani, MBBS; Robert D. Sperduto, MD; [et al](#)

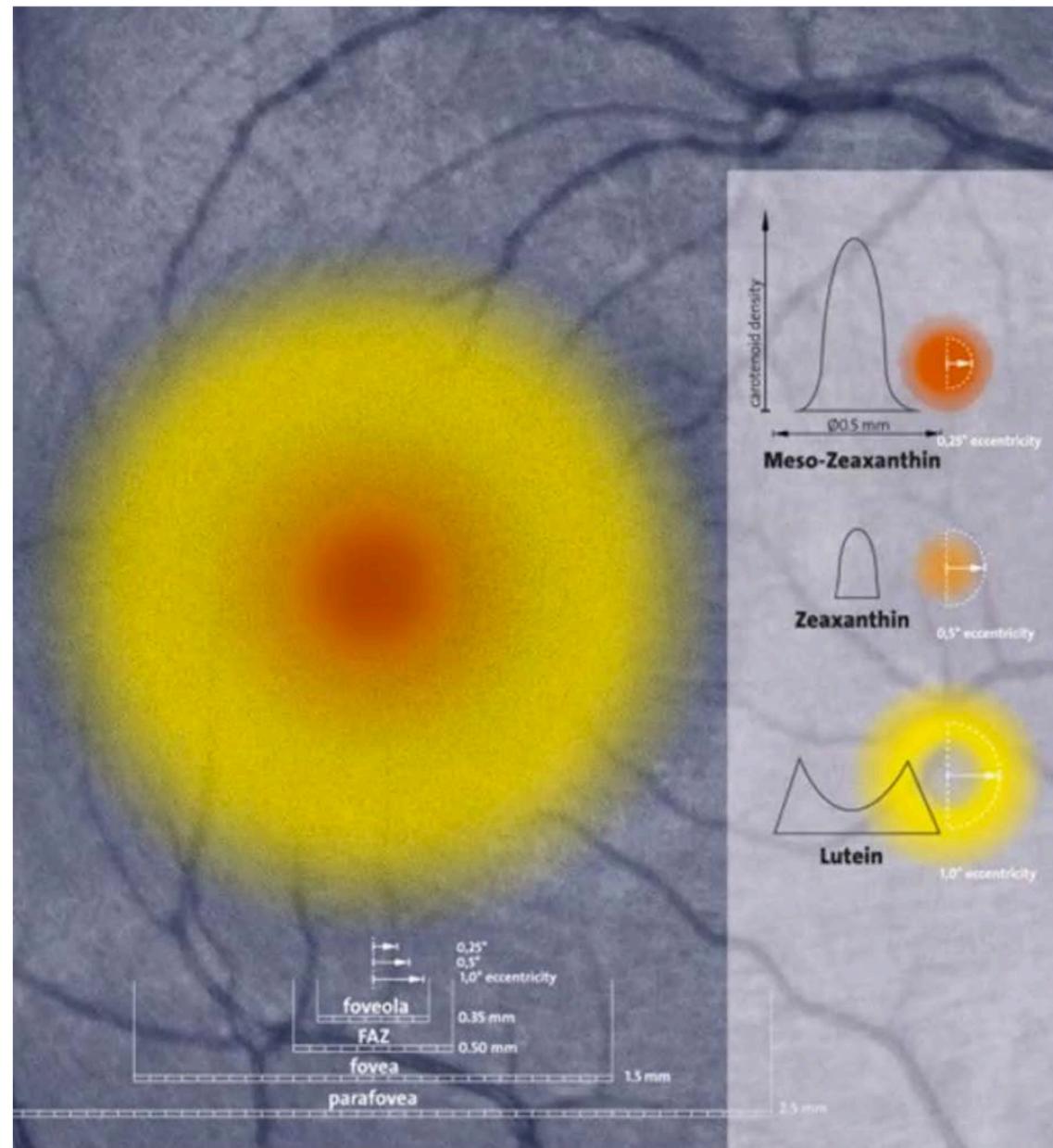
» [Author Affiliations](#)

JAMA. 1994;272(18):1413-1420. doi:10.1001/jama.1994.03520180037032

Results. —A higher dietary intake of carotenoids was associated with a lower risk for AMD. Adjusting for other risk factors for AMD, we found that those in the highest quintile of carotenoid intake had a 43% lower risk for AMD compared with those in the lowest quintile (odds ratio, 0.57; 95% confidence interval, 0.35 to 0.92; *P* for trend=.02). Among the specific carotenoids lutein and zeaxanthin, which are primarily obtained from dark green, leafy vegetables, were most strongly associated with a reduced risk for AMD (*P* for trend=.001). Several food items rich in carotenoids were inversely associated with AMD. In particular, a higher frequency of intake of spinach or collard greens was associated with a substantially lower risk for AMD (*P* for trend<.001). The intake of preformed vitamin A (retinol) was not appreciably related to AMD. Neither vitamin E nor total vitamin C consumption was associated with a statistically significant reduced risk for AMD, although a possibly lower risk for AMD was suggested among those with higher intake of vitamin C, particularly from foods.



The Macular (Xanthophyll) Carotenoids



- lutein
- zeaxanthin
- meso-zeaxanthin



Dietary Macular Carotenoids and Macular Degeneration

Original Investigation

December 2015

Intakes of Lutein, Zeaxanthin, and Other Carotenoids and Age-Related Macular Degeneration During 2 Decades of Prospective Follow-up

Juan Wu, MS¹; Eunyoung Cho, ScD^{2,3,4}; Walter C. Willett, MD, MPH, DrPH^{1,4,5}; [et al](#)

» [Author Affiliations](#) | [Article Information](#)

JAMA Ophthalmol. 2015;133(12):1415-1424. doi:10.1001/jamaophthalmol.2015.3590

- Over 100,000 participants followed for 26 years
- Predicted plasma carotenoid scores based on food frequency questionnaires
- 1361 cases of intermediate AMD
- 1118 cases of advanced AMD
- Higher carotenoid intake associated with inverse risk of advanced AMD by **40%** (Relative Risk [RR] = 0.59; 95% CI, 0.48-0.73; *P* for trend < .001)

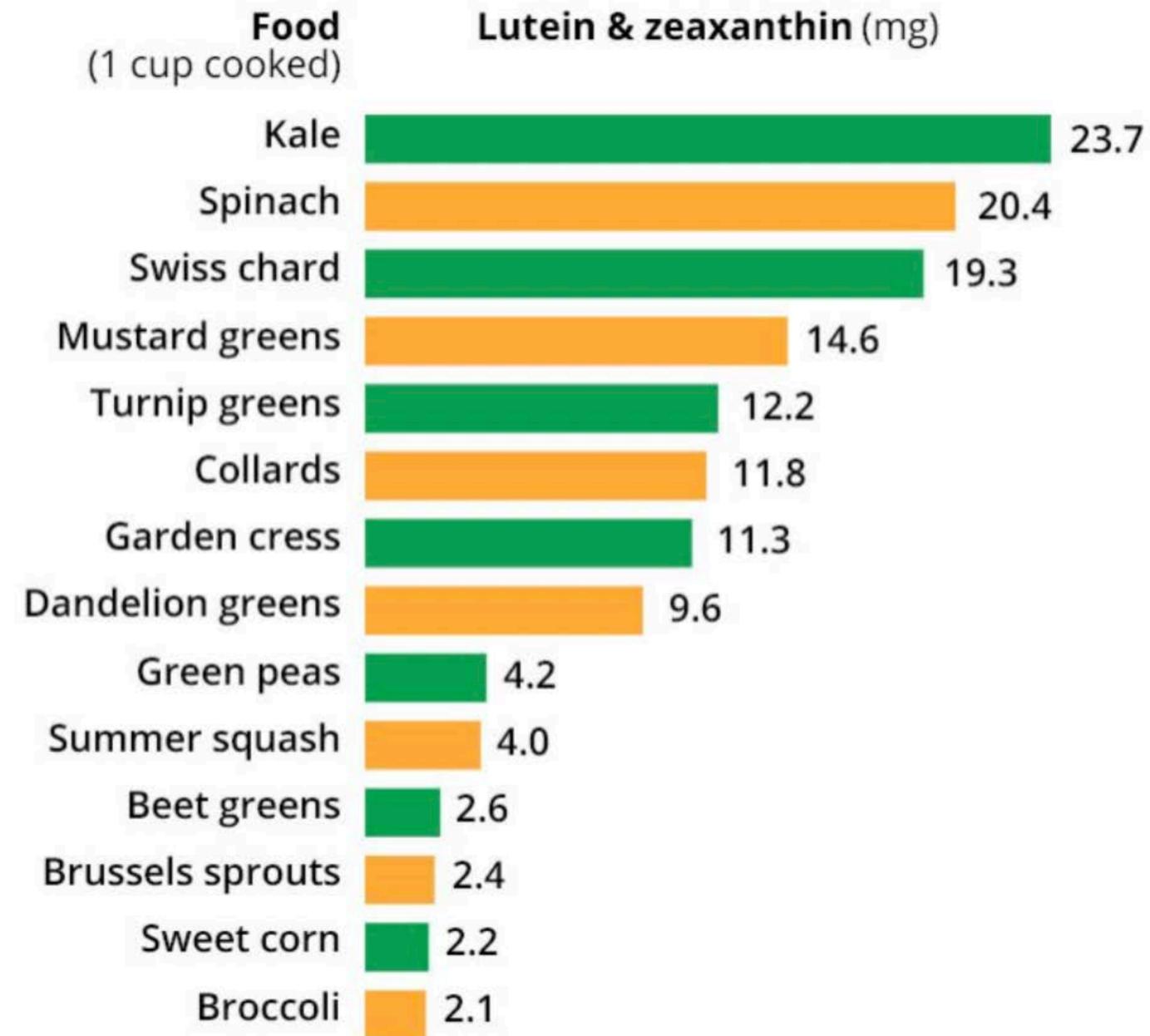


Recommended Daily Intake of Macular Carotenoids vs. What Most People on a Western Diet Get Daily

- lutein: 6.5 - 10 mg/day → 1-2 mg/day
- zeaxanthin: 1-2 mg/day → < 1 mg/day



Food Sources of Lutein and Zeaxanthin



Source: USDA National Nutrient Database for Standard Reference, Release 22 (2009)



Mediterranean Diet Score and Its Association with Age-Related Macular Degeneration

The European Eye Study

Ruth E. Hogg, PhD,¹ Jayne V. Woodside, PhD,¹ Alanna McGrath, BSc,¹ Ian S. Young, MD,¹ Jesus L. Vioque, MD, PhD,² Usha Chakravarthy, MD, PhD,¹ Paulus T. de Jong, MD,³ Mati Rahu, PhD,⁴ Johan Seland, MD,⁵ Gisele Soubrane, MD,⁶ Laura Tomazzoli, MD,⁷ Fotis Topouzis, MD,⁸ Astrid E. Fletcher, PhD⁹

- 4753 participants across 7 centers
- Mean age 73, 55% women
- Mediterranean Diet lowered risk for nvAMD (wet AMD) by 47%



AMD- Minimize Risk for Vision Loss

- Diet high in vegetables and fruits lowers risk

- Carotenoids

- Lutein
- Zeaxanthin

- Antioxidants

- Vitamin C
- Vitamin E



Supplements for AMD: AREDS and AREDS 2

Clinical Trial > Arch Ophthalmol. 2001 Oct;119(10):1417-36. doi: 10.1001/archopht.119.10.1417.

A randomized, placebo-controlled, clinical trial of high-dose supplementation with vitamins C and E, beta carotene, and zinc for age-related macular degeneration and vision loss: AREDS report no. 8

Age-Related Eye Disease Study Research Group

PMID: 11594942 PMCID: PMC1462955 DOI: 10.1001/archopht.119.10.1417

Lutein + zeaxanthin and omega-3 fatty acids for age-related macular degeneration: the Age-Related Eye Disease Study 2 (AREDS2) randomized clinical trial

Age-Related Eye Disease Study 2 Research Group

Collaborators + expand

PMID: 23644932 DOI: 10.1001/jama.2013.4997



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Supplements for AMD: AREDS and AREDS 2

Nutrient	AREDS formula*	AREDS2 fomula
Vitamin C	500 mg	500 mg
Vitamin E	400 IU	400 IU
Beta-carotene	15 mg	-
Copper (cupric oxide) **	2 mg	2 mg
Lutein	-	10 mg
Zeaxanthin	-	2 mg
Zinc	80 mg	80 mg

The AREDS and AREDS 2 formula (source: National Institute of Health)

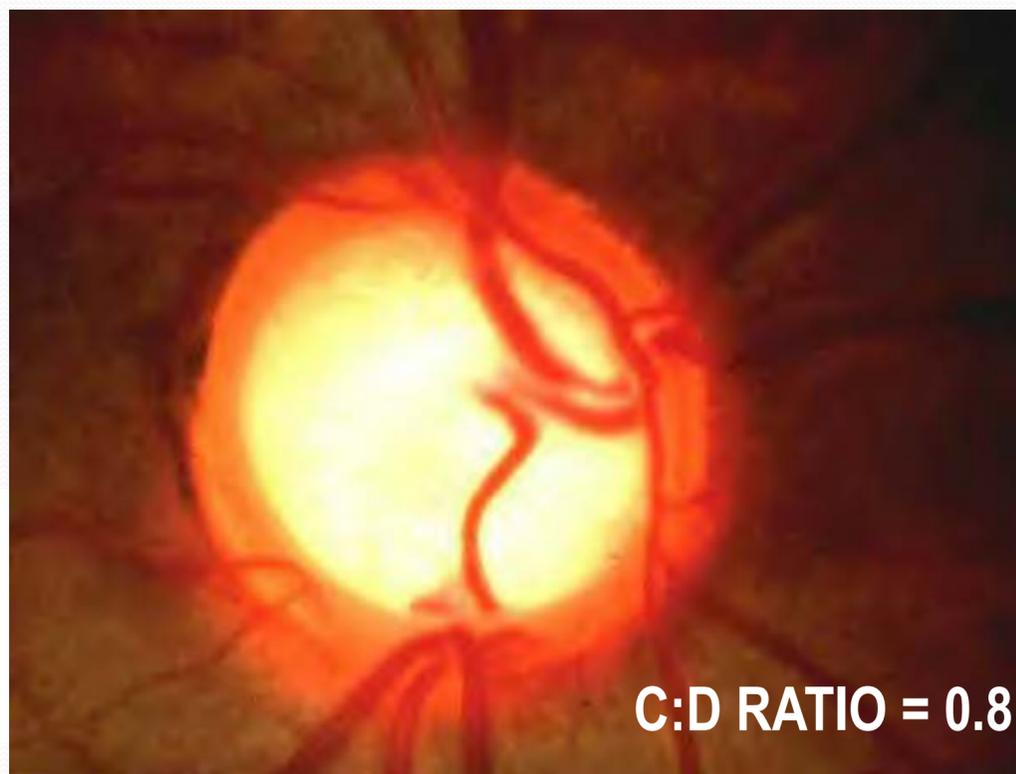
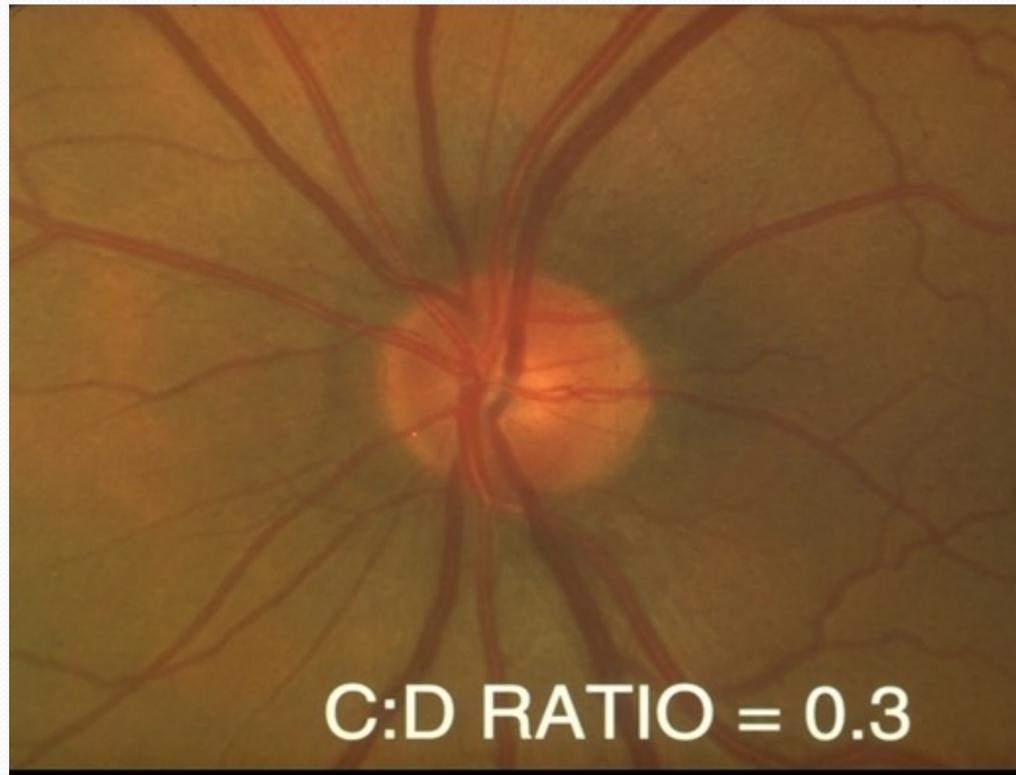
****AREDS2 Formula reduced the risk of progression from intermediate to advanced AMD by ~ 28%**

Glaucoma



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What is Glaucoma?



- Optic nerve damage associated with peripheral visual field loss
- May be associated with high intraocular pressure



Glaucoma



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Reduction of Glaucoma Risk via Nutrition

- 3+ servings of fruit per day: 79% decreased risk compared to those with < 1 serving
- Leafy greens: 20-30% less risk
- 1 cup of tea: 74% decreased risk

- Nutrients: B2 (riboflavin), Magnesium
- Other foods: nuts, seeds (Vitamin E, omegas)

References:

- Giacconi, Joann A., et al. *American Journal of Ophthalmology*, vol. 154, no. 4, 2012, pp. 635-44
- Kang JH, Willett WC, Rosner BA, Buys E, Wiggs JL, Pasquale LR. *JAMA Ophthalmol*. 2016 Mar;134(3):294-303. doi: 10.1001/jamaophthalmol.2015.5601
- Wu CM, Wu AM, Tseng VL, et al *British Journal of Ophthalmology* 2018;**102**:1127-1133.

Effects of Mirtogenol[®] on ocular blood flow and intraocular hypertension in asymptomatic subjects

Robert D. Steigerwalt Jr.,¹ Belcaro Gianni,¹ Morazzoni Paolo,² Ezio Bombardelli,² Carolina Burki,³ Frank Schönlau⁴

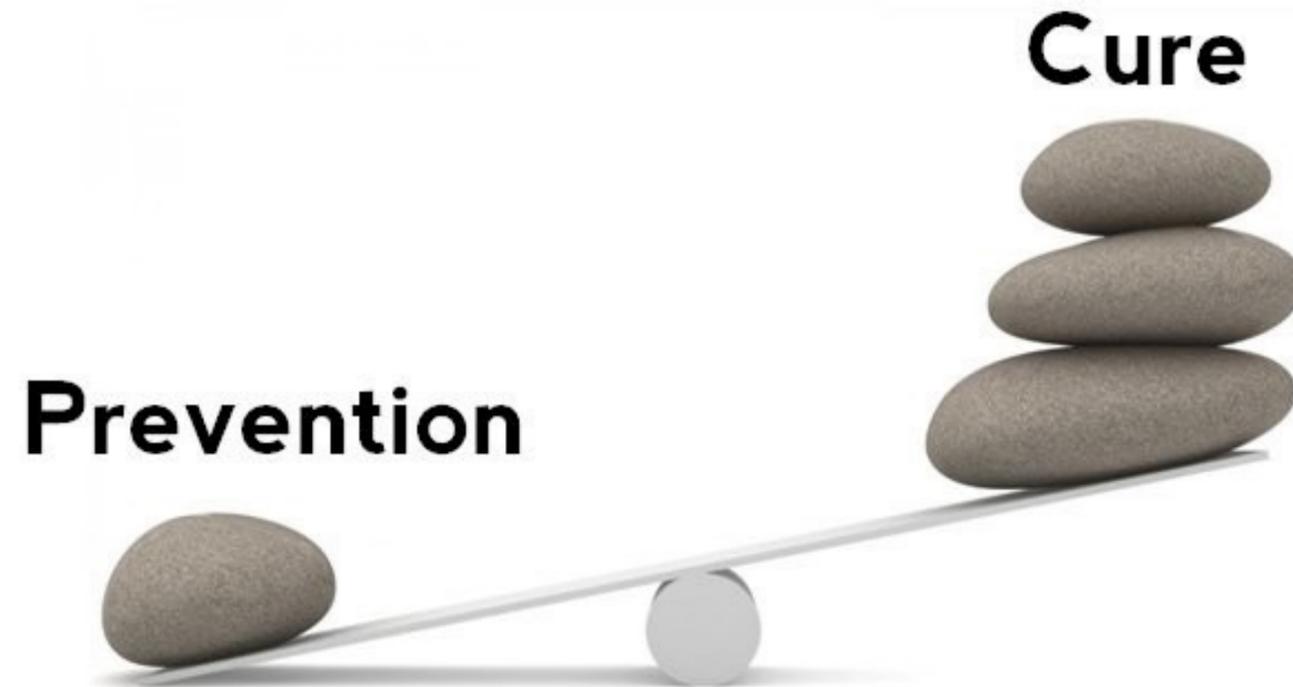
¹Department of Biomedical Sciences, University of Chieti-Pescara, San Valentino, Italy; ²Indena S.p.A. Scientific Department, Milan, Italy; ³Horphag Research (UK) Ltd., Geneva, Switzerland; ⁴Horphag Research (UK) Ltd., London, United Kingdom

- Pine bark extract + bilberry extract
- 38 subjects with ocular HTN
 - 20 treated
 - 18 untreated
- Treated subjects had 3.0 mm Hg decrease in IOP and improved ocular blood flow based on Color Doppler



When it comes to eye conditions-
"An ounce of prevention is worth a pound of cure."

- Benjamin Franklin, 1763



And the best way to prevent vision loss is
eye-healthy nutrition



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How to Counsel Patients on an Eye-Healthy Diet



Daily green smoothie



- 3 cups of leafy greens
- 1 cup berries
- 1-2 tbs of seeds
- 1/4 cup nuts
- Plant-based milk of choice
- 1-2 scoops of protein powder
- Ice



Strategy #2: Eat the Rainbow





Eat The Rainbow!



- Eat lots of colorful vegetables and fruits daily
- Rule of 21:
 - 3 meals a day, 7 days a week = 21 meals/week
 - Strive for a different color with each meal, so 21 *DIFFERENT* colors each week



Strategy #3: Avoid S.A.D Foods

S = Standard
A = American
D = Diet



Standard American Diet "SAD"

- Unhealthy fats (high in Omega-6 fatty acids)
- Ultra-processed foods
- Refined carbohydrates



August 2001

Dietary Fat and Risk for Advanced Age-Related Macular Degeneration

Johanna M. Seddon, MD; Bernard Rosner, PhD; Robert D. Sperduto, MD; et al

» [Author Affiliations](#) | [Article Information](#)

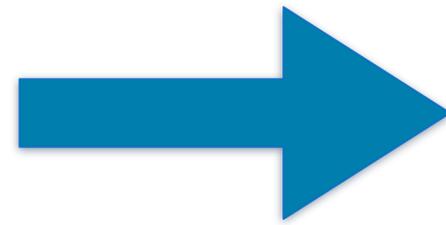
Arch Ophthalmol. 2001;119(8):1191-1199. doi:10.1001/archopht.119.8.1191

- Trends toward increased AMD risk with higher intakes of monounsaturated and polyunsaturated fats, linoleic acid
- Lower risk with high omega 3 and fish intake



S.A.D. Alternatives

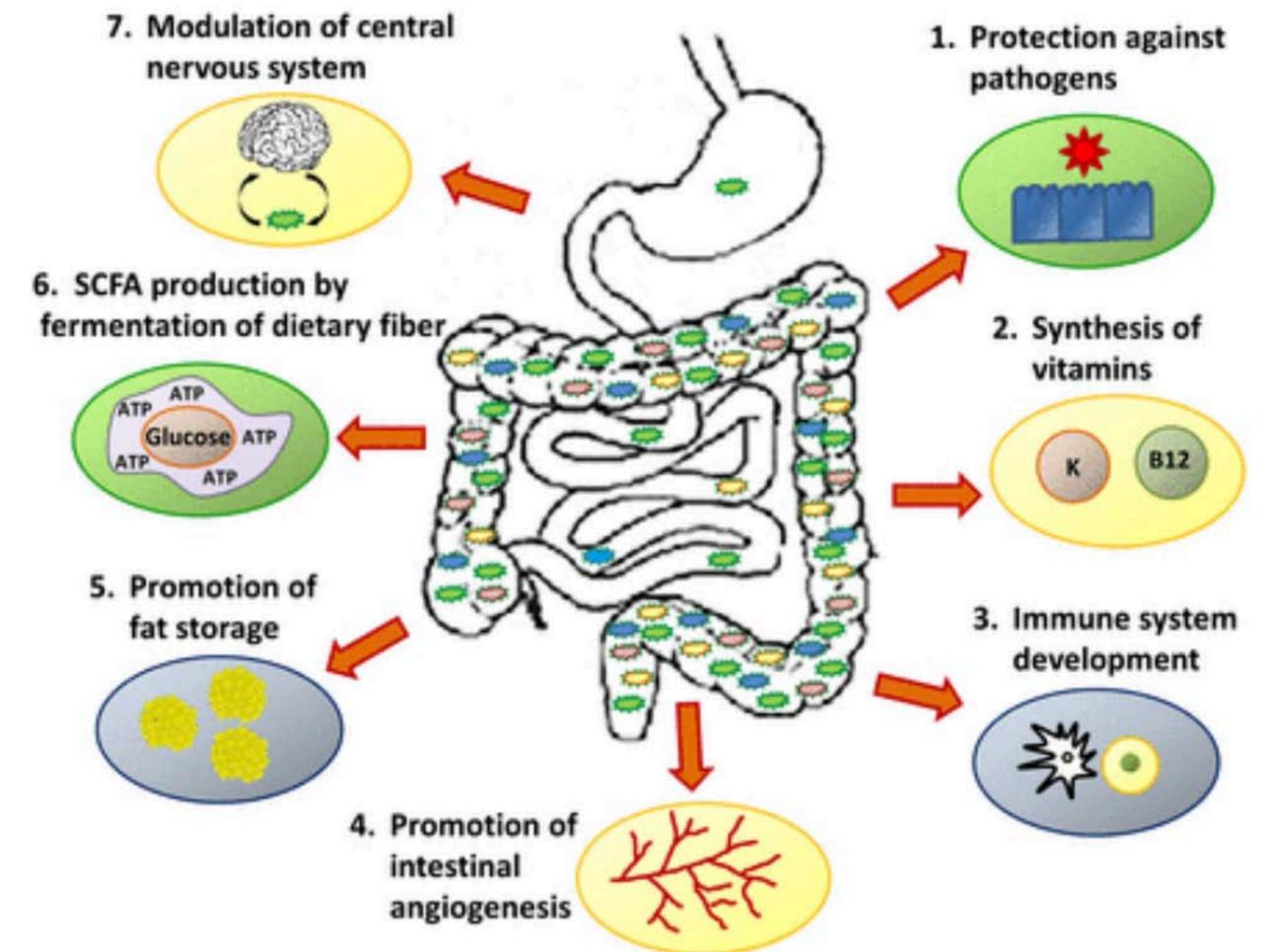
- High in Omega-6 fatty acids
 - Deep fried
 - Saturated fats
 - Trans fats
- Processed foods
- Refined carbohydrates



- Rich in Omega-3s
- Healthy fats
- Raw/Natural Foods
- Unprocessed Foods
- Whole grains
- Natural sugars



Strategy #4: Support a Healthy Gut Microbiome



Gut Dysbiosis and Ocular Disease*

- Dry Eye
- Macular Degeneration
- Uveitis
- Glaucoma

*Napolitano et al. Influence of gut microbiota on eye diseases: an overview. Ann Med 2021.



How can you support a healthy gut microbiome?

- Probiotics
- Beneficial Bacteria
 - Live Probiotics
 - Supplement



How can you support a healthy gut microbiome?

- Prebiotics
- Foods That Healthy Bacteria Thrive On

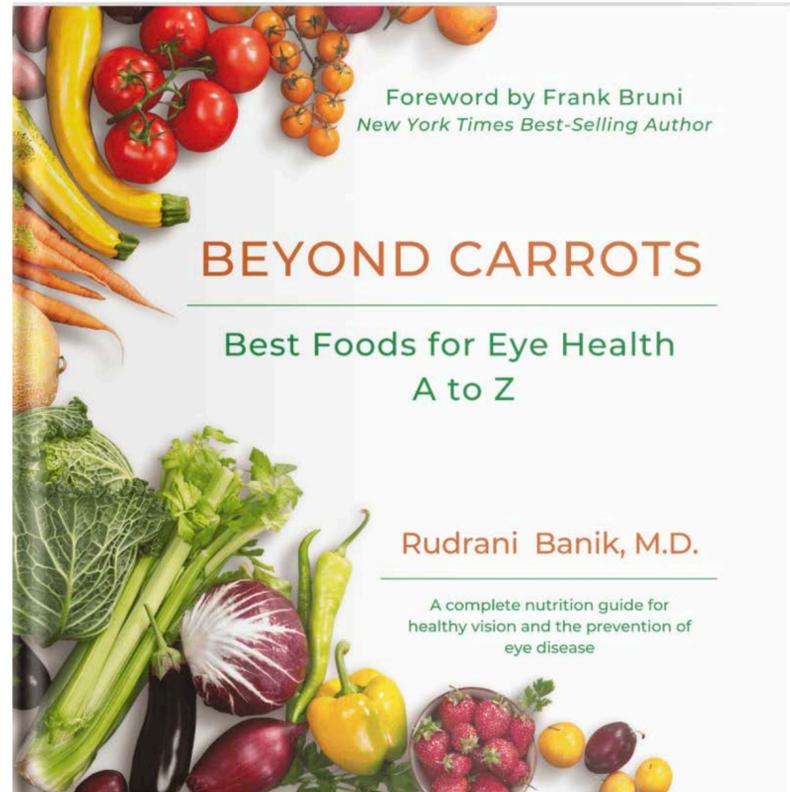


Beyond Carrots: 4 Strategies for an Eye-Healthy Diet

- A plant-rich diet
- 21 colors a week
- Avoid SAD foods
- Support the gut microbiome



Beyond Carrots - Best Foods For Eye Health A to Z



Dr. Rani's Visionary Kitchen





Let food be thy medicine,
& medicine be thy food. -Hippocrates



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Eye on Migraine
The Macular Degeneration Diet & Lifestyle



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