

## Ocular Nutrition for Best Patient Outcomes

Cira Collins, ABOM, MPH

### Eye Structures

Structure	Refractive Power	Index of Refraction	Vascular/Avascular	How it receives nutrition
Tear Film Layer	Minimal but important	1.336	Avascular	Tear Glands and Meibomian Glands
Cornea	43 Diopters	1.376	Avascular	Aqueous Humor Bath and Tear Film
Anterior Chamber	Minimal	1.335	Walls are vascular, chamber is not	Vascular walls
Lens	12-15 Diopters	Variable - 1.42	Avascular	Aqueous Bath
Posterior Chamber	Minimal	1.337	Walls are vascular, chamber is not	Vascular walls
Vitreous	Minimal	1.335	Avascular	Provides much nutrition to interior structures of the eye
Retina	None	None	Highly Vascular	Blood Supply

### Compounds

Name	Type	Dosage	Found In	Considerations
Vitamin A	Fat Soluble Vitamin	Adults: 700mcg/women, 900mcg/men Daily RDA	Dark Leafy Vegetables, Yellow and orange colored fruits and vegetables	Needed for all vision as part of the phototransduction cascade
Vitamin C	Water Soluble Vitamin	Adults: 75mg/women 90mg/men Daily RDA	Bell peppers, kiwil, strawberries, oranges, papaya	Cornea epithelium and lens have high levels of Vitamin C
Vitamin E	Fat Soluble Vitamin	15mg/day	Almonds, wheat germ, avocado, sunflower seeds	Neutralizes oxidation in the eyes

Omega-3 Fatty Acids	Essential Fatty Acids	1000-3000 mg daily	Fish Oil, Walnut, Flax, Basil Seed, hempseed, salmon, eggs	
Zinc	Mineral	40-80 mg daily	Oysters, meat, fish seafood	Blocks copper absorption, so if taking Zinc, adding 2mg copper is recommended.
Selenium	Mineral	40- 70mcg daily	Brazil nuts, seafoods, organ meats	Reduces inflammation and oxidative stress, can be overdosed
Magnesium	Mineral	350 mg daily	Green leafy vegetables, nuts, seeds, whole grains	Can help with sleep. Magnesium transports Potassium
Potassium	Mineral	4,700mg daily	Bananas, leafy greens, potatoes, winter squash, lentils	
Lutein	Carotenoid	10-20mg daily	Raw egg yolks, kale, broccoli, spinach	Buttermilk and lutein studies demonstrate powerful effects
Zeaxanthin	Carotenoid	2mg daily	Egg yolks, peaches, persimmons, dark leafy greens	Similar to betacarotene
Astaxanthin	Carotenoids	4-18 mg daily	Derived from Algae, Yeast, Krill, Salmon, Trout, Crayfish	Increases Antioxidant enzyme profile, Increases ocular blood flow
Anthocyanins	Antioxidant	100-300 mg daily	Cocoa, Blueberries, Strawberries, Pomegranate, Billberry	Overall nerve health
Idebenone	Related to Anti-oxidants	5mg/kg daily	Derivative of CoQ10	Helps reverse Leber's Hereditary Optic Neuropathy
Sea Buckthorn Oil	Supplement	2g daily	Sea Buckthorn plant	Decreases redness and dryness in dry eye patients

Trehalose	Plant sugar	100mM in Saline 6x daily	Sugar found in many plants known to survive dessication, The Rose of Jherico	Increases TBUT in dry eye patients
Red Light and Near Infrared Light	Light therapy	670nm at 1 foot away from 2-3 min daily		Light penetrates cells and stimulates ATP production inside cells. Improves VA and improves color improvement (22% improvement in Tritan scores)Light , reduces Drusen

#### Conditions

<b>Condition</b>	<b>Supplements</b>	<b>Effects</b>	<b>Considerations</b>
Dry Eye	Fish Oil, Omega-3 Fatty Acids	Anti-Inflammatory, improved osmolarity of tear film	New research emerging on Pycnogenol, Sea Buckthorn Oil and Trehalose
Glaucoma	Omega-3 Fatty Acids, High Doses of Vitamin B3	Prevents disease progression, lowers pressures	Cannabis is only good while the patient is high.
AMD	AREDS and AREDS2	Slow disease progression	Smokers should avoid beta-carotene and use AREDS2.