**Lutein with OptiLut®**

**INGREDIENTS**
Doctor’s Best Lutein features Marigold extract, a potent source of lutein standardized to contain 90% lutein esters. Marigold flowers are the most abundant source of lutein in nature. An oral bioavailability study of lutein that examined two formulations discovered that the lutein ester formulation was nearly 62% more bioavailable than the nonesterified form of lutein. Lutein and zeaxanthin are yellow pigments in a class of carotenoids called xanthophylls. Since the human body does not synthesize them, we rely on dietary sources for these carotenoids. The average American consumes only 2 mg per day of lutein & zeaxanthin (the best sources are dark leafy greens like spinach, collards, and kale, in addition to certain yellow-orange fruits & vegetables). Lutein, and zeaxanthin (a xanthophyll believed to be derived from a photochemical transformation of lutein) are referred to as “the macular pigments,” as they are the only carotenoids found in the lens and macular tissue in the human eye retina.

**BENEFITS**
- Helps maintain healthy visual function
- Helps protect eyes from damaging blue light
- Helps reduce risk of age-related macular degeneration (AMD)
- Helps improve visual function in early AMD
- Helps neutralize free radicals

**RESEARCH FINDINGS**
Researchers measured the ability of lutein and zeaxanthin supplementation to affect visual processing speed. Visual psychophysics provides a relatively simple and precise means of measuring visual processing speed called the temporal contrast sensitivity function (tCSF). A past study has shown that macular pigment (a collection of xanthophylls, lutein (L) and zeaxanthin (Z), found in the retina) molecular pigment optical density (MPOD) was positively correlated with tCSF. The study found these correlations when testing 102 young healthy subjects. As a follow-up, the researchers randomized 69 subjects to receive a placebo (n=15) or L and Z supplements (n=54). MPOD and tCSF were measured psychophysically at baseline and 4 months. Neither MPOD nor tCSF changed for the placebo condition, but both improved significantly from supplementation. These results show that supplementation with L and Z can increase processing speed, even in young, healthy subjects.

Another study assessed whether higher macular pigment optical density (MPOD) and lutein (L) and zeaxanthin (Z) supplementation are related to improvements in glare disability, photostress recovery, and chromatic contrast. This study used a randomized, double-blind, placebo-controlled design. The visual effects of 1 year of supplementing L (10 mg/d) and Z (2 mg/d) were investigated. One hundred fifteen young, healthy subjects were recruited and randomized into the study (58 received placebo, 57 L+Z). The study concluded that daily supplementation with L+Z resulted in significantly increased serum levels and MPOD and improvements in chromatic contrast and recovery from photostress. These results are consistent with past studies showing that increasing MPOD leads to improved visual performance.

A different study examined the effect of lutein supplementation on visual function in healthy drivers with long-term light exposure. The study was a randomized, double-blind, placebo-controlled, 1-year intervention study. It included 120 normal participants (drivers). The active (A) group consumed 20 mg of lutein daily. Participants were assessed at baseline, 1, 3, 6, and 12 mo. Assessment included visual acuity, serum lutein concentrations, macular pigment optical density (MPOD), and visual performance. At the onset and at end of intervention, dietary intakes of lutein and visual-related quality of life were measured. The study concluded that daily supplementation with 20 mg of lutein increases MPOD levels and that lutein may benefit night driving and other spatial discrimination tasks carried out under low illumination.

Supplement Facts

<table>
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<tr>
<th>Serving Size</th>
<th>2 veggie capsules</th>
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<tr>
<td>Servings per container</td>
<td>60 servings</td>
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<table>
<thead>
<tr>
<th>Amount per serving</th>
<th>% Daily Value</th>
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<tbody>
<tr>
<td>Free Lutein (from OptiLut® Lutein Esters)</td>
<td>20 mg</td>
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<tr>
<td>Zeaxanthin (from OptiLut®)</td>
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† Daily Value not established.

**Other Ingredients:** Microcrystalline cellulose, hypromellose (vegetarian capsule), silicon dioxide and magnesium stearate (vegetable source).

**Suggested Adult Use:** Take 2 capsules daily, with or without food, or as recommended by a nutritionally-informed physician.

**Non-GMO / Gluten Free / Soy Free / Vegan**

Store in a cool dry place.

* These statements have not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure or prevent any disease.
Many people take measures to protect their eyes from ultra violet (UV) light. A more recently discovered concern for eye health is blue light. In certain wavelengths, blue light is implicated in development of age-related macular degeneration (AMD). Nowadays, smart phones, computers, tablets, LED and fluorescent lights -- most of which emit high levels of blue light -- are ubiquitous. So, the exposure to blue light is everywhere, and increasing. Constant exposure to blue-violet light can accumulate over time, with the potential to damage retinal cells, which can cause retinal cell death, leading to AMD.8,9

A study compared action spectra for visual discomfort in the fovea and the parafovea and to determine the effect of macular pigment (MP). Visual discomfort thresholds to lights from 440 to 600 nm were obtained for six young (<35 y), visually normal subjects with a wide range of MP densities. Foveal and parafoveal conditions were compared. Discomfort thresholds were also obtained for xenon-white light, and a broadband yellow light. MP was measured psychophysically using heterochromatic flicker photometry (HFP). The study concluded that MP simultaneously reduces visual discomfort and protects from light damage at short wavelengths. These findings indicate that the spectral absorption properties and spatial distribution of MP combine to protect the retina while enhancing visual performance.10

Three dietary carotenoids, lutein (L), zeaxanthin (Z) and meso-zeaxanthin (MZ) accumulate at the central retina (macula), where they are collectively referred to as macular pigment (MP). MP's pre-receptorial absorption of blue light and consequential attenuation of chromatic aberration and light scatter effects are important for optimal visual function. Furthermore, antioxidant activity of MP's constituent carotenoids and the same blue-light-filtering properties underlie the rationale for its putative protective role for age-related macular degeneration (AMD). Supplementation with L, Z and MZ augments MP and enhances visual performance in diseased and non-diseased eyes, and may reduce risk of AMD development and/or progression.11

A research team studied macular pigment ocular density (MPOD) in patients with early age macular degeneration (AMD) before and one year after nutritional supplementation with lutein and docosahexaenoic acid (DHA). Forty-four patients with AMD were randomly divided into two groups receiving placebo (n = 21) or nutritional supplement (n = 23, 12 mg of lutein and 280 mg of DHA daily). Heterochromatic flicker photometry was used to determine MPOD. The researchers concluded that lutein and DHA supplementation is effective in increasing MPOD and may aid in prevention of age-related macular degeneration.12

A meta-analysis examined whether an association exists between blood levels of antioxidants or vitamins and age-related cataract in observational studies. The researchers reviewed 13 studies with 18,999 participants. The researchers concluded that their meta-analysis provides additional evidence supporting the view that blood levels of lutein and zeaxanthin are inversely associated with risk of age-related cataract.13

A separate study investigated functional and macular pigment (MP) changes in patients with early age-related macular degeneration (AMD) after supplementation with lutein and zeaxanthin. 112 patients with early AMD were randomly divided into two groups receiving placebo (n = 56) or a nutritional supplement (n = 56, 10 mg of lutein and 10 mg of zeaxanthin), daily for 2 years. MP optical density (MPOD) was recorded at baseline, 48 weeks and 2 years. Retinal sensitivities were measured by multifocal electroretinogram for peak-to-trough amplitude (NIPI) at baseline and at 48 weeks, and in terms of microperimeter-determined mean retinal sensitivity (MRS) at 48 weeks and 2 years. The study concluded that supplementation with lutein and/or zeaxanthin increases MPOD, and supplemental lutein enhances retinal sensitivity in patients with early AMD.14

Other researchers examined effects of lutein and zeaxanthin supplementation on retinal function using multifocal electroretinograms (mFERG) in patients with early age-related macular degeneration (AMD). This was a randomized, double-masked, placebo-controlled trial of 108 subjects with early AMD, randomly assigned to receive 10 mg/d lutein (n = 27), 20 mg/d lutein (n = 27), 10 mg/d lutein plus 10 mg/d zeaxanthin (n = 27), or placebo (n = 27) for 48 weeks. Thirty-six age-matched controls without AMD were also enrolled to compare baseline data with early AMD patients. mFERG responses and macular pigment optical densities (MPODs) were recorded and analyzed at baseline and at 24 and 48 weeks. The researchers concluded that early functional abnormalities of the central retina in early AMD patients could be improved by lutein and zeaxanthin supplementation. These improvements may be potentially attributed to MPOD elevations.15

Another study evaluated whether zeaxanthin (Zx) supplementation raises macular pigment optical density (MPOD) and has visual benefits for patients with early atrophic macular degeneration having visual symptoms but lower-risk National Institute of Health/National Eye Institute/Age-Related Eye Disease Study characteristics. This was a 1-year, n = 60, 4-visit, intention-to-treat, prospective, randomized controlled clinical trial of patients with mild-to-moderate age-related macular degeneration (AMD) randomly assigned to 1 of 2 supplement intervention groups: 8 mg Zx (n = 25) and 8 mg Zx plus 9 mg lutein (L) (n = 25) or 9 mg L (“Faux Placebo,” control group, n = 10). The study concluded that, in older male patients with AMD, Zx-induced foveal MPOD elevation mirrored that of L and provided complementary, distinct visual benefits by improving foveal cone-based visual parameters, whereas L enhanced those parameters associated with gross detailed rod-based vision, with considerable overlap between the 2 carotenoids.16

A different research team investigated effects of a 12-month intervention with macular xanthophylls (lutein and zeaxanthin) and ω-3 LC-PUFAs on xanthophylls and fatty acids in plasma, antioxidant capacity, and optical density of macular pigment in patients with nonexudative AMD. The study was a randomized, double-blind, placebo-controlled, parallel clinical trial, conducted for 12 months with 145 participants. Participants were divided as follows: placebo group, group 1 (daily capsule 10 mg lutein, 1 mg zeaxanthin, 100 mg docosahexaenoic acid, and 30 mg eicosapentaenoic acid), and group 2 (twice the dose used in group 1). The researchers concluded that supplementing with lutein, zeaxanthin, and ω-3 LC-PUFAs for 12 months significantly improved plasma antioxidant capacity, circulating macular xanthophyll levels, and the optical density of the macular pigment.17

Another study aimed to determine whether lutein affects oxidative damage biomarkers. A randomized, double-blind, placebo-controlled trial of lutein supplementation was conducted. 117 subjects were randomly assigned to receive 10 or 20 mg/d of lutein or placebo for 12 weeks. Plasma carotenoid concentrations, total antioxidant capacity (TAOC), lipoprotein profile, and antioxidant enzymes activities were determined at baseline and at 6, and 12 weeks after treatment. Biomarkers of oxidative damage to protein and lipids, and C-reactive protein (CRP) concentrations were measured at baseline and after supplementation. The study found that plasma lutein and TAOC significantly increased in both treatment groups. Lutein supplementation decreased lipid peroxidation by increasing plasma lutein concentrations and antioxidant capacity.18

A different study investigated whether orally-administered carotenoids increase skin radical scavenging activity and radical protection using in vivo electron paramagnetic resonance spectroscopy. Also, skin lipid profile was investigated applying HPTLC on skin lipid extracts. Furthermore, in vivo Raman resonance spectroscopy was used to measure the cutaneous carotenoid concentration. A double blind, placebo-controlled clinical study was performed with 24 healthy volunteers. Treatment group showed a slow but significant and effective increase in cutaneous carotenoids. Carotenoids increased skin radical scavenging activity, providing significant protection against stress-induced radical formation. These results indicate that supplementation with carotenoids can protect the skin against reactive oxygen species and could reduce premature skin aging and other radical-associated skin diseases.19
Another clinical trial was designed to study the efficacy of lutein and zeaxanthin, two potentially important antioxidants found naturally in the skin, upon five skin physiology parameters (surface lipids, hydration, photoprotective activity, skin elasticity and skin lipid peroxidation - malondialdehyde) of human subjects. These xanthophyll carotenoids were administered either orally, topically, or in combination (both oral and topical routes). The results show that oral supplementation of these antioxidants individually provides significant activity in the skin. In addition, oral administration of lutein may provide better protection than topical application when measured by changes in lipid peroxidation and skin photoprotective activity following UV light irradiation.20

SAFETY
Pathology analysis suggested no adverse clinical implications of consuming lutein or zeaxanthin.21

The totality of evidence on beneficial and adverse effects from Age-Related Eye Disease Study (AREDS2) and other studies suggests that lutein/zeaxanthin could be more appropriate than beta carotene in AREDS-type supplements.22

SCIENTIFIC REFERENCES

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