



# Eye Health & Nutrition

## AFTER AREDS2



American Optometric Association



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# AFTER AREDS2

The much-anticipated AREDS2 trial results were released earlier this year. The study was designed to assess whether nutritional interventions might slow the progression from intermediate to advanced age-related macular degeneration (AMD). Publicized conclusions state that the addition of lutein, zeaxanthin and omega-3 fatty acids to the original AREDS formulation had “no significant effect” above that achieved with the original AREDS formulation. However, the study results themselves tell a far different story. Here, we examine the study results in the context of other current, relevant research and offer practical clinical recommendations for eye care practitioners.



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Dr. Kimberly Reed is the Director of the Ocular Nutrition Clinic at Nova Southeastern University's (NSU) Eye Care Institute, and teaches courses in ocular disease, pharmacology, and nutrition at NSU. She is an active lecturer and writer on these topics. She is active in several national organizations serving optometry and nutrition, and is a fellow of the American Academy of Optometry.



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Dr. Steven Ferrucci is currently Chief of Optometry at the Sepulveda VA Ambulatory Care Center and Nursing Home. He is also the Residency

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**JEFFRY D. GERSON,**  
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Dr. Jeff Gerson has been a frequent writer and lecturer on the topic of AMD on a national level for approximately 10 years. He has been

seeing patients on a consultative basis for colleagues for that time, and is a fellow of Optometric Retinal Society, American Academy of Optometry and former Kansas Optometric Association young OD of the year.



**A. PAUL CHOUS,**  
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Dr. Paul Chous received his Masters and Doctor of Optometry degrees with highest honors from UC Berkeley, is a member of the AOA

Evidence Based Optometry and Health Promotions Committees, serves as the AOA representative to the NIH National Diabetes Education Program, and is on the Editorial Boards of Review of Optometry and Optometry Times. He has a private practice specializing in diabetes eye care & education in Tacoma, WA, is a frequent lecturer and writer on the subjects of diabetes, nutrition and retinal disease, and is Principal Investigator for the Diabetes Visual Function Supplement Study.



**STUART RICHER,**  
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Dr. Stuart Richer received his Masters and Doctor of Optometry degrees from UC Berkeley and a PhD in Human Physiology and Biophysics from

Rosalind Franklin University of Medicine and Science (RFUMS), where he is an associate professor of Family and Preventive Medicine. He was principal investigator of 3 randomized double masked, placebo controlled trials on AMD and nutrition utilizing: 1) Multivitamins (1996), 2) Lutein (LAST 2004) and 3) Zeaxanthin (ZVF 2011). In medical center practice for 32 years, he currently coordinates the ocular preventive medicine clinical laboratory, and a primary care residency program, at the James A Lovell Federal Health Care Facility in North Chicago, IL. Dr. Richer is national research director of the Ocular Nutrition Society.





## ■ BEYOND THE HEADLINES

**REED:** Many of us were surprised by the relatively flat results that were initially reported from the AREDS2 study, despite the fact that the results actually show a significant benefit from lutein and zeaxanthin. What is the most significant ‘take home’ message from AREDS2?

**RICHER:** The *JAMA* published conclusion and a variety of press releases regarding the AREDS2 study, convey that neither omega-3 fatty acids nor lutein and zeaxanthin had an appreciable effect beyond the original AREDS formulation in prevention of catastrophic vision loss in the AMD study population. Beyond the headlines, the actual data indicates that the typical American, consuming the typical dietary intake of these nutrients (i.e. a couple of milligrams), can delay central vision blindness if they supplement with 10 mg lutein and 2 mg zeaxanthin. The published supplementary “secondary analysis” commentary is very different from what appeared in print, which reported only on statistically stringent endpoints, for the study’s atypical, well-nourished study population. While there was a non-statistically significant 10% additional reduction in progression (beyond AREDS 1) from intermediate to advanced AMD in the groups taking an AREDS 1 supplement containing an additional 10 mg of lutein and 2 mg of zeaxanthin, patients in the lowest quintile of habitual dietary carotenoid (i.e. approx 1 to 2 mg) intake benefited far more. This is the most important clinically useful finding. Not much can be gleaned from the omega-3

data as the placebo group was even better nourished in terms of habitual fish consumption.

**CHOUS:** A 32% risk reduction for progression to cataract surgery was found as well in the subjects with the lowest dietary intakes of lutein and zeaxanthin. And while cataract isn’t an untreatable disease like geographic atrophy, it’s still an important cause of visual compromise in our aging adult population. Eliminating or delaying cataract surgery with nutritional intervention can provide a significant quality of life benefit to many patients, and additionally can provide significant reductions in health care spending for cataract surgery.

**REED:** The original AREDS study in many ways pioneered the use of nutritional supplements as a very successful therapeutic intervention for what was previously an untreatable disease. What were the specific results of that study?

**GERSON:** Briefly, that study found a 25% risk reduction in progression from intermediate to advanced AMD with the daily combination of 400 IU vitamin E, 500 mg vitamin C, 15 IU beta-carotene, and 80 mg of zinc. AREDS also reported a 19% reduction in risk of vision loss with the same formula. What was interesting at the time is that zinc turned out to be so important in the formulation. The researchers were able to isolate the individual effects of zinc vs. the antioxidants because their study design had a placebo group, a zinc group, an antioxidant group, and a group with both zinc and antioxidants.



AMERICANS GETTING THE  
TYPICAL LOW AMOUNTS  
OF DIETARY LUTEIN AND  
ZEAXANTHIN (1–2 MG) CAN  
**PROTECT THEIR  
VISION** WITH DAILY LUTEIN  
(10 MG) AND ZEAXANTHIN (2 MG)  
SUPPLEMENTATION.

## ■ NO TRUE PLACEBO

**RICHER:** The protection offered by zinc was first reported in the late 1980's, by David Newsome, who found that in a smaller study of about 150 patients, subjects taking 100 mg zinc lost significantly less vision than those in the placebo group. That was the first controlled study showing a benefit in macular degeneration using oral supplements. It's also important to realize that these early studies were groundbreaking, in that they studied intakes of these nutrients far in excess of the RDA. That was somewhat controversial at the time.

**REED:** Compared to these earlier studies, AREDS2 was a complicated study, involving many sub-groups of patients. What was the rationale for the design complexity in AREDS2?

**FERUCCI:** Because it has been the standard of care to recommend AREDS type supplements to patients with intermediate AMD, it wasn't possible to have a true placebo group that wasn't taking some version of AREDS. So nearly all of the patients in AREDS2 were actually taking the original AREDS or some modification of that supplement, either by reducing the zinc, eliminating the beta-carotene, or both. AREDS2 tested whether adding 10 mg of lutein and 2 mg of zeaxanthin, 350 mg DHA/650 mg EPA, or a combination of the two to the AREDS formulation was beneficial. Specifically, they wanted to see if these new substances reduced the risk of progression to advanced AMD by an additional 25% as compared to study subjects taking the original AREDS supplement, which was the study control arm. That control arm is why there was no true placebo group, because no study group was taking a real placebo. They were all taking at least a version of a supplement that had already been proven to have benefit.

**CHOUS:** That complex design was further complicated by the statistical analysis that was applied to the data. In most clinical trials, a confidence interval (CI) of 95% is used. That means that if statistical significance is met, there is a strong 95% chance that the results achieved were due to the intervention or treatment and only a 5% probability that the results were due solely to random chance. In the original AREDS study, the 95% CI was applied, but in AREDS2, it was 98.7%. That means they needed a larger effect to reach statistical significance.

MOST AMERICANS  
ONLY GET **10%**  
OF THE LUTEIN AND  
ZEAXANTHIN  
NEEDED EACH  
DAY FROM  
DIETARY  
SOURCES.



**REED:** Dr. Richer referred earlier to a “typical American eating a typical amount of lutein and zeaxanthin.” It’s well recognized that most U.S. adults don’t reach the RDI of many nutrients. What is a “typical American” and what are those “typical amounts” of lutein and zeaxanthin, specifically?

**CHOUS:** On average, Americans take in somewhere between 1 and 2 milligrams (mg) of lutein and zeaxanthin, combined, per day. In contrast, the subjects in the AREDS2 study were better nourished than the average U.S. adult. In fact, when the AREDS2 study groups were stratified based on intake of nutrients, the group with the lowest quintile intake of lutein and zeaxanthin was in that same range of 1–2 mg per day. So the least-nourished patients in AREDS2 were consuming about the same amount as an average person. 10 mg of lutein and 2 mg of zeaxanthin were studied in AREDS2, far above the typical American intake.

AREDS2 PATIENTS WERE BETTER  
NOURISHED THAN THE AVERAGE AMERICAN.

## ■ AREDS COMPARISONS

**FERUCCI:** And while it's theoretically possible to achieve these intake levels with foods, the reality is that most patients aren't eating sufficient quantities of spinach, kale, goji berries, and other foods rich in lutein and zeaxanthin, day in and day out. This is where supplementation comes in—to fill that dietary gap.

**REED:** The subjects included in AREDS2 were different in other ways as well, as compared to the original AREDS study. For example, 9% of subjects in AREDS were taking statins, and 44% in AREDS2 were on a statin medication. What other differences were there, and what effects might those differences have had on the study outcomes?

**FERUCCI:** The most obvious difference in study subjects, and it's an important one, is that the subjects in AREDS2 were older than those in AREDS. For an age-related disease, that's a significant consideration. And while it's true that there were many more subjects taking statin medications in AREDS2, that's a reflection of the changing population and medical practices. Those types of differences are inevitable in long term studies like these. What we have to do is interpret the data in the context of today's clinical practice.

**CHOUS:** Also, there were more diabetics in the AREDS2 study population as compared to AREDS. And there were differences in the proportion of diabetics within some of the study's subgroups as well. What stands out to me is that people with diabetes

were significantly under-represented in the group receiving lutein and zeaxanthin, by approximately 20%. Those are the very people who would likely benefit most from supplementation with an antioxidant of any source, due to the increased level of oxidative stress that we know is associated with diabetes.

**REED:** What were some of the other surprising features in the study design and data analysis?

**RICHER:** We can't ignore the potential influence of the Centrum Silver® multivitamin/mineral (MVM) supplement. Remember that about 2/3 of the patients in AREDS were taking Centrum Silver, and in AREDS2, that number was 89%. As much as people discount these types of MVM supplements, it's been proven that Centrum actually has a statistically significant 9% protective effect against cancer, according to a recent published study. So if we're comparing AREDS to AREDS2 results, and evaluating why a larger effect wasn't seen across all study sub-groups, we can't overlook the potential influence of magnesium, selenium and in particular B vitamin deficiency—which has already been linked to several other diseases, that like AMD, are neurodegenerative in nature.

**GERSON:** This underscores the importance of individualized patient care. As much as we value these studies with thousands of subjects to inform us about trends in disease progression, we can't lose sight of the fact that we're managing individual patients, not study groups. Each patient is going to have his or her own set of risk factors, and those include any systemic diseases they have, medications they are taking, MVM intake, and very importantly, the types of food they typically eat.

## SEE THE DIFFERENCE



AREDS1	AREDS2
Younger—average age 69	Older—average age 74
All AMD stages	AMD Stage 3 & 4
Typical U.S. Diet	Well Nourished
Diabetes—7%	Diabetes—13%
67% on Centrum Silver	89% on Centrum Silver

## ■ LUTEIN & ZEAXANTHIN— MORE THAN JUST AN “ACCEPTABLE SUBSTITUTE”

**GERSON (CONT):** A person who eats spinach and kale all the time is going to have a different nutritional profile than someone who avoids those foods. So the statistics are important, and these trends—findings that don’t necessarily reach statistical significance but are present nonetheless—are also very important as they guide us in making specific recommendations to our patients. In the context of AREDS2, the statistics about the study’s primary endpoints may say one thing, but the potential advantage to a patient may be far greater.

**REED:** Let’s look at some of the potential adverse effects that were found in AREDS2. For example, beta-carotene was again seen to have an association with lung cancer in former smokers. Is there any reason to consider beta-carotene in AMD prevention any more?

**GERSON:** Because of the increased risk of lung cancer in smokers taking beta-carotene supplements that was discovered during AREDS and several other studies, current smokers were not randomized to any group that contained beta-carotene in the study supplement. Interestingly, AREDS2 found an increased association with lung cancer in patients who had ever smoked—not just current smokers. This led to the recommendation that beta carotene be dropped from AMD supplements, and replaced with lutein and zeaxanthin as carotenoid substitutes.

**RICHER:** And this is another piece of data that was obscured in the report. When you look at the group of subjects taking lutein and zeaxanthin-containing supplements without beta-carotene in AREDS2, there was an 18% reduction in risk of progression of AMD, compared to subjects taking the original AREDS containing beta-carotene. This is independent of the quintiles of intake of these nutrients, and this is due at least in part to the competitive inhibition in absorption of the various carotenoids. In essence, having beta carotene in abundance reduces the serum levels and protective effects of lutein and zeaxanthin. It turns out that the lutein/zeaxanthin combination is more than just an ‘acceptable substitute’ for beta-carotene—it is significantly more powerful in providing protection to our AMD patients—both in the fovea and parafoveal retina.

**FERRUCCI:** Another thing that we shouldn’t lose sight of is that patients should be cautioned that supplementation isn’t designed to reverse the damage that has already been done, or to restore

### NEI Recommendation

## AREDS2 Formulation

**Vitamin C** (500 mg)

**Vitamin E** (400 IU)

~~**Beta Carotene** (15 mg)~~

**Lutein** (10 mg)/**Zeaxanthin** (2 mg)

**Zinc** (80 mg zinc oxide)

**Copper** (2 mg cupric oxide)

~~**Omega 3 fatty acids** (DHA/EPA)~~

AREDS2 INVESTIGATORS RECOMMEND  
REMOVING BETA CAROTENE AND  
REPLACING IT WITH **LUTEIN AND  
ZEAXANTHIN** FOR A SAFER AND  
MORE EFFICACIOUS FORMULATION.

vision. They need to understand that going in, to avoid disappointment. To us, the best outcome expected from an AREDS2 supplement is preventing further loss, not restoring vision in most cases—and patients should be fully informed of that as a part of individualized care.

**REED:** Were there any findings that have been previously reported as potential risks with these supplements that were NOT found in AREDS2?

**CHOUS:** In AREDS, there was an increased incidence of urinary tract infection requiring hospitalization attributed to the 80 mg of zinc. That was not seen in AREDS2. Also, there has been a lot of recent controversy regarding vitamin E supplementation and specifically the risk of death due to cardiovascular incidents. Neither AREDS nor AREDS2 found this association, or any increased risk of death from other causes, including cancer, as a result of the study supplements.





**SUPPLEMENTAL MESO-ZEAXANTHIN IS DIFFERENT THAN DIETARY ZEAXANTHIN AND IS SYNTHETICALLY MADE FROM LUTEIN USING HIGH HEAT AND A STRONG ALKALINE ENVIRONMENT.**

MESO-ZEAXANTHIN WAS NOT INCLUDED IN AREDS2. THE RESEARCHERS DIDN'T BELIEVE THERE WAS SUFFICIENT SCIENCE TO INCLUDE IT IN THEIR FORMULATION.

### ■ ADDS TO THE BODY OF EVIDENCE FOR LUTEIN AND ZEAXANTHIN

**REED:** Even before AREDS2 results were released, many of us were recommending relatively high doses of lutein and zeaxanthin to AMD patients based on a number of other studies supporting this practice. Did the AREDS2 study results modify your practice regarding these nutrients?

**GERSON:** I think AREDS2 mainly solidified my belief that most patients will benefit from this level of supplementation with these carotenoids. But again, we can't ignore individualized care for our patients that may be even more significantly undernourished than the patients enrolled in AREDS2, and at the same time we can't ignore those that are living much healthier lifestyles than the average person. Some patients, for example those who are obese, may arguably need more than 10 mg of lutein and 2 mg of zeaxanthin, and probably some patients could do fine with less.

**FERUCCI:** I agree with Dr. Gerson. We've known for many years about the positive benefits of lutein and zeaxanthin in macular function. AREDS2 just added more weight to the already substantial body of evidence in this regard.

**REED:** *Meso-zeaxanthin is another macular pigment, along with lutein and zeaxanthin. But it's very uncommon in the diet, in foods not typically eaten such as shrimp shells and turtle fat. In fact the three pigments are thought to be present in equal proportion at the macula. Yet meso-zeaxanthin wasn't included in the AREDS2 formulation, and most thought leaders do not commonly recommend it. Why is this?*

**RICHER:** The science is still emerging regarding *meso-zeaxanthin*. Approximately 20% to perhaps as high as 40% of AMD patients, especially those of advanced age and smokers, have an exaggerated central foveal dip in their spatial macular pigment distribution curve. The goal of supplementation with carotenoids is to promote re-pigmentation of that dip. At this point it is unclear as to which specific nutrients—lutein (L), zeaxanthin (Z), or *meso-zeaxanthin* (M)—in which ratios will accomplish the goal most effectively. The AREDS2 researchers, at pre-planning, didn't believe there was sufficient science regarding *meso-zeaxanthin* to include it in their formulation. The AREDS2 ratio of L:Z:M was 5:1:0 (trace) was based on the human diet. The serum level of L:Z:M is 3:1:0 has not as yet been evaluated.

The LAST study demonstrates that lutein alone can increase the macular pigment and the ZVF study suggests that repigmentation of the fovea can be achieved with higher dose of zeaxanthin than the 2mg present in the AREDS2 formulation. Lutein might also convert to *meso-zeaxanthin*, albeit in a longer time frame than high dose *meso-zeaxanthin*. Thus only 2 pigments might be required, after-all, given a longer time frame that's quite typical for supplement users.

These issues were also debated this past summer at the 2nd annual International Macular Carotenoid Conference in Cambridge, England. The bottom line is these are still unanswered scientific questions, and our answers will have to incorporate time frame of effect, genetics, binding proteins, inclusion of all 3 carotenoids and in what ratio, and other factors that might not even be known at this time.

**FERUCCI:** Supplemental *meso-zeaxanthin* is clearly different from dietary zeaxanthin. Some supplement bottles state the product contains zeaxanthin when it is in fact synthetic *meso-zeaxanthin* created from lutein using high heat and a strong alkaline environment.



## ■ IMPORTANCE OF SPECIFIC RECOMMENDATIONS

**REED:** How much importance do you place on the specific source of these nutrients? Is one supplement just as good as any other? Is this something that needs to be communicated to patients?

**FERRUCCI:** Without a doubt, this is one of the areas where the source and formulation matter a great deal. We just spoke briefly about *meso*-zeaxanthin, and the general consensus is that it is probably not needed in supplement form. FloraGLO® Lutein was the lutein brand used in AREDS2 and it's what is used in the majority of relevant clinical studies. Other formulations may claim to have pure non esterified lutein, but when tested, they may have just a fraction of lutein and a lot of other metabolites that aren't the same—and may have no effect whatsoever.

**RICHER:** Likewise, there are 3 isomeric forms of zeaxanthin, and some supplements that are labeled as zeaxanthin don't have the specific dietary isomer of zeaxanthin studied in this and many other studies. As Dr Ferrucci mentioned, some lesser-quality supplements actually have *meso*-zeaxanthin instead of the zeaxanthin isomer proven to be beneficial to visual function. This is why it's important to do the legwork in researching which supplement companies you want to recommend to your patients. Telling your patient to 'take a supplement containing lutein and zeaxanthin' is inadequate. At best, the patient may waste money on an ineffective product, and at worst, they are denied the specific and significant

benefit imparted from good quality supplements and science.

**GERSON:** I couldn't agree more. Handing a patient a specific product recommendation with specific dosing instructions is essential. Whether that be in the form of a sample, a coupon, or a tear-off sheet indicating a specific brick-and-mortar or Internet vendor where the patient can buy the product you recommend, the patient needs to leave your office with something tangible. Retailing directly from your office is another option.

**REED:** The 1000 mg daily intake of omega-3 fatty acids was included in AREDS2 as 650 mg of EPA and 350 mg of DHA, in ethyl ester form. But there are other studies showing that about twice that amount is required, on a daily basis, for most people to reach a specific level of red blood cell membrane saturation of 8%—the level that is strongly associated with significant overall health benefits. What is your opinion about AREDS2's selected formulation and dose?

**CHOUS:** There is a specific test that's available now to measure the actual saturation of red blood cell membranes with the beneficial omega-3 fatty acids. It's called the Holman Omega 3 Index, and it can be accessed through labs or directly through the company for home use. Unfortunately, we don't have complete data from AREDS2 showing the omega-3 levels for the subjects during the study. But other literature, specifically the cardiovascular research, strongly supports a higher intake through food or supplements, in the range of 2000 mg per day.



**FLORAGLO® LUTEIN** WAS  
THE LUTEIN BRAND USED IN AREDS2 AND  
IT'S WHAT IS USED IN THE MAJORITY OF  
RELEVANT CLINICAL STUDIES.

## ■ PREVENTION AT ANY AGE

**REED:** There have been other studies suggesting an increased health risk with high intake of omega-3's, specifically for prostate cancer in men. Still other studies reiterate the cardiovascular benefits of these fatty acids. How has the recent literature modified your recommendation of omega-3's to your patients, if at all?

**RICHER:** The apparent lack of effect in AREDS2 with this dose of omega-3 fatty acids hasn't changed my practice with respect to recommending a good quality omega-3 supplement to my patients. I believe the cardiovascular health benefits significantly outweigh any risks, assuming patients are under good medical care for any systemic issues they may have or develop. The SELECT prostate cancer study is controversial, and offset by a plethora of other studies showing the exact opposite trend. We have to consider the preponderance of scientific evidence (epidemiologic, biologic and prospective), and not just isolated statistical studies.

**REED:** AREDS2 evaluated patients who already had intermediate AMD, and measured risk of progression to either wet AMD or geographic atrophy. But what have we learned from other major clinical trials about patients with early AMD, or those who are at risk for AMD due to family history or genetic risk?

**GERSON:** It's true that once a patient shows up with intermediate AMD, despite the powerful results shown with nutritional intervention, a large percentage of patients will still progress to neovascular AMD or geographic atrophy. We have to remember that once a patient presents with large drusen, it's more likely that they WILL progress to vision loss, despite our best efforts. The idea is to try to prevent patients from qualifying for a hypothetical AREDS3 study—that is, how can we minimize the risk of them ever getting even to intermediate AMD status? This is where preventive medicine comes in, and possibly genetic testing to evaluate risk and direct treatment.

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THERE IS A GROWING BODY OF EVIDENCE THAT LUTEIN AND ZEAXANTHIN SPECIFICALLY, IMPROVE VISUAL FUNCTION EVEN IN **YOUNG, HEALTHY PATIENTS**—NOT JUST THOSE WITH AMD OR AT RISK FOR IT.



**CHOUS:** And along those lines, lifestyle education to even our young patients is essential as well. For example, a secondary analysis of AREDS patients' dietary intake suggested that eating a diet with a dietary glycemic index (dGI) at or below the same sex median reduced the risk of advanced AMD by 49%. If subjects had a dGI below the same sex median, 20% of prevalent AMD cases would have been eliminated. This is so important for people to recognize. Modifying diet and food choices is as powerful, or more so, than the supplements we are studying.

**RICHER:** And don't forget that there is a growing body of evidence that lutein and zeaxanthin specifically, improve visual function even in young, healthy patients—not just those with AMD or at risk for it. Data suggest that these dietary macular pigments, when in adequate supply, diminish glare disability while enhancing glare recovery, contrast sensitivity, temporal processing speeds, chromatic contrast, and visual range. The visual benefits of the carotenoids provide more reasons to start the nutritional conversation with patients of all ages. Likely we will learn that other carotenoids, for example astaxanthin, play an increasingly prominent role in our nutrition conversations with future patients.

## ■ AREDS2 HIGHLIGHTS

**REED:** This has been a great conversation looking at the AREDS2 study outcomes and related literature. Thank you all for your insights.

- AREDS2 found that for the average American, with an average diet, lutein and zeaxanthin proved to be extremely beneficial in the prevention of AMD progression. Therefore, supplementation is recommended in most patients at risk for vision loss from AMD, due to the relatively poor American diet.
- The goal of supplementation is not to reverse damage already done, but help prevent or slow down further loss. Patients should be counseled to avoid unrealistic expectations.
- Higher dietary consumption of refined carbohydrates is a risk factor for the development and progression of AMD. Optometrists should counsel their patients about this relationship.
- There is sufficient evidence that beta-carotene may be more harmful than helpful in many patients.
- The science is still emerging regarding meso-zeaxanthin and its benefit in promoting macular re-pigmentation in AMD patients. Currently, there is insufficient evidence to support its widespread use in these patients.
- It's never too early to start talking to your patients about healthy nutrition and lifestyle choices, as it is a lifetime accumulation of these habits that contribute to protection against catastrophic vision loss from AMD.
- Not all supplements are created equal. Make sure that the supplements you recommend or sell to your patients contain not only a sufficient amount, but also a proven source of lutein and zeaxanthin.
- It's important to give clear direction to your patient regarding the supplement you recommend. Hand them a sample, a coupon, or a prescription. Make sure they understand where to obtain the supplement, what the dosage should be, and what the goal of supplementation is.
- Along with lifestyle, family history, and clinical findings, future genotype analysis of AREDS2 participants may significantly impact individualized recommendations for ocular supplements.

### For Further Reading:

- AREDS Report no. 8<sup>(1)</sup>
- Blue Mountains Eye Study<sup>(2)</sup>
- Beaver Dam Eye Study<sup>(3)</sup>
- AREDS2 Report no. 1<sup>(4)</sup>
- AREDS2 Report<sup>(5)</sup>
- AREDS2 Report no. 4<sup>(6)</sup>
- Zeaxanthin and Visual Function Study<sup>(7,8)</sup>
- LAST and LAST II<sup>(10,11)</sup>

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