MERCOLA
Take Control of Your Health

Research on Astaxanthin Demonstrates Significant Whole Body Benefits

Analysis by Dr. Joseph Mercola | December 18, 2023

STORY AT-A-GLANCE

- Astaxanthin is a potent antioxidant with broad-spectrum, system-wide health benefits, offering protection against radiation and promoting skin, eye, brain and heart health
- A potent anti-inflammatory, astaxanthin is useful for virtually any inflammatory condition, from joint problems, such as rheumatoid arthritis, to cancer
- Key differences that sets astaxanthin apart from other carotenoids include the ability to handle multiple free radicals simultaneously, protect both water-and fat-soluble parts of the cell, and the inability to function as a pro-oxidant

Editor's Note: This article is a reprint. It was originally published February 20, 2017.

Astaxanthin, which is part of the carotenoid family, is thought to be the most potent antioxidant nature has to offer, and mounting research suggests it has broad-spectrum, system-wide health benefits.

It's derived from Haematococcus microalgae, which produces astaxanthin as a protective mechanism to shield the fragile algae from harsh ultraviolet (UV) light and other environmental stressors. Astaxanthin's benefits are so numerous, I've written several articles to cover its activities, from radiation protection, to eye, brain, lung[1] and heart health.

Other health benefits noted in a scientific review published in Molecular Nutrition and Food Research in 2011 included the prevention and treatment of:[2] "cancers … metabolic syndrome, diabetes, diabetic nephropathy … gastrointestinal diseases, liver diseases … male infertility and $HgCl_2$-induced acute renal failure."

Importantly, astaxanthin is a very potent anti-inflammatory, making it useful for virtually any inflammatory condition, including joint problems such as rheumatoid arthritis, carpal tunnel syndrome and tennis elbow.

It's also been shown to improve athletic performance, in part by ameliorating exercise-induced fatigue. It has broad versatility[3,4,5] and exceptional safety, even at extremely high doses.

What Makes Astaxanthin so Unique?

Astaxanthin is related to beta-carotene, lutein and canthaxanthin. However, its unique molecular structure makes it both more potent and unique than other carotenoids.

For example, astaxanthin has 550 times stronger antioxidant power than vitamin E, and is 6,000 times more potent than vitamin C. Other key differences that sets astaxanthin apart from other carotenoids include the following five features:

- Like other antioxidants, astaxanthin donates electrons to neutralize free radicals. However, while this free electron donation depletes most other antioxidants, astaxanthin has a massive surplus that allows it to remain active far longer — at least one order of magnitude longer than most other antioxidants.

  The astaxanthin also remains intact, meaning there are no chemical reactions to break it down, which is what occurs in most other antioxidants.

- Another major difference is in the number of free radicals it can handle. Most antioxidants, such as vitamins C, E and various others, can typically handle only one free radical at a time. Astaxanthin can address multiple free radicals simultaneously, in some cases more than 19 at the same time. It does this by

forming an electron cloud around the molecule. This is known as the electron dislocation resonance.

When free radicals try to steal electrons from the astaxanthin molecule, they're simply absorbed into and neutralized by this electron cloud, all at once.

- One of astaxanthin's most unique features is its ability to protect both water- and fat-soluble parts of the cell. Carotenoids are typically divided into water-soluble or fat-soluble, but astaxanthin belongs to an in-between group that can interface between both water and fat.

  This means the astaxanthin molecule can affect and expand the biolipid membrane of ALL cells. It's not simply floating around in your bloodstream; it actually integrates into the cellular membrane.

  This includes the mitochondrial membranes of your heart cells, which is one of the reasons it's so beneficial for your heart. Since mitochondrial health is a key factor in aging, supporting mitochondrial health is also one of the primary strategies to help slow down the overall aging process. It also has the ability to cross the blood-brain barrier, which is part of its neuroprotective ability.

- Another key feature is that it cannot function as a pro-oxidant. Many antioxidants will act as pro-oxidants (meaning they cause rather than combat oxidation) when present in sufficient concentrations.

  This is one of the reasons why you don't want to go overboard taking too many antioxidant supplements. Astaxanthin, on the other hand, does not function as a pro-oxidant, even when present in high amounts, which makes it both safer and more beneficial.

- Astaxanthin acts on at least five different inflammation pathways, making it a very potent anti-inflammatory, and maintains balance within the system.

Astaxanthin Helps Protect Your Skin From the Inside Out

Well over 100 studies demonstrate the safety of astaxanthin, even at mega-doses as high as 500 milligrams (mg) per day. About the only side effect ever documented at higher doses is the possibility of developing a slight reddening of the skin, which most people tend to find attractive.

Astaxanthin is also very beneficial for skin health in general, as it helps protect against UV (sun) damage,[6,7,8] increases skin elasticity, reduces fine wrinkles and improves the moisture level in the skin. When it comes to UV radiation protection, astaxanthin specifically helps protect against UV-induced cell death.

Unlike topical sun block, astaxanthin does not actually block UV rays, so it doesn't prevent UVB from converting into vitamin D in your skin; it simply protects your skin against damage. This protective effect is so potent studies even show it helps protect against:

- Total body irradiation,[9] primarily by scavenging intracellular reactive oxygen species (ROS) and reducing cell apoptosis (programmed cell death)
- Burn-wound progression, by reducing oxidative stress-induced inflammation and mitochondrial-related apoptosis[10]

How Astaxanthin Benefits Your Heart and Cardiovascular System

Quite a few studies have focused on astaxanthin's impact on heart and cardiovascular health, showing it can be extremely beneficial in this area.

For example, in one double-blind, placebo-controlled study,[11] people who took 12 milligrams (mg) of astaxanthin per day for eight weeks had a 20% decrease in levels of C-reactive protein (CRP), which is a marker for heart disease.

CRP is essentially an indicator of systemic inflammation in your body, and lower levels tend to be associated with a reduced risk of not only heart disease but many other chronic health problems as well. Needless to say, a 20% decrease in CRP in just two

months is a rather dramatic reduction in disease risk, and one that few if any drugs can match.

According to Gerald Cysewski, Ph.D., a former assistant professor at the Department of Chemical Engineering at UC Santa Barbara and founder of Cyanotech, the first company to produce natural astaxanthin, studies have also shown astaxanthin protects your heart and cardiovascular system by:

- Improving blood flow
- Decreasing blood pressure
- Improving blood chemistry by increasing high density lipoprotein (HDL cholesterol), lowering low-density lipoprotein (LDL) and decreasing triglycerides
- Decreasing oxidation of LDLs that contributes to arterial plaque buildup

The Neuroprotective Effects of Astaxanthin

More than a dozen studies also show astaxanthin protects your neurons and can slow the effects of age-related cognitive decline and psychomotor function decline.[12]

In one study, they found people taking either 6 or 12 mg of astaxanthin per day had significantly decreased accumulation of phospholipid hydroperoxides (PLOOH), which is a marker for dementia. It may therefore also have therapeutic benefit against Alzheimer's.

In another double-blind, placebo-controlled study done in Japan, elderly volunteers with age-related forgetfulness improved both their cognition scores and psychomotor function/coordination after taking 12 mg of astaxanthin for 12 weeks.

A number of animal studies have even shown that astaxanthin can drastically limit the damage caused by a stroke, when consumed PRIOR to the stroke — which brings us to the issue of absorption. It takes approximately 12 to 19 hours for astaxanthin to reach its maximum level in your bloodstream. After that, it decays over a three- to six-hour period.

This means you need to take it at least one day ahead of time to ensure tissue saturation. That said, if you're using it for, say, sun or radiation protection, your best bet is to take it consistently for a few weeks beforehand, to allow it to build up in your system.

Astaxanthin Is a Potent Protector of Vision

Many studies have also investigated astaxanthin's effect on eye health. Some of the early work was done in France, where they confirmed that astaxanthin can cross the blood-retinal barrier, thereby providing potent anti-inflammatory protection to your eye and retina. Studies suggest it may help protect against a variety of eye-related problems, including:

Age-related macular degeneration (ARMD)	Cataracts
Inflammatory eye diseases (i.e., retinitis, iritis, keratitis, and scleritis)	Retinal arterial occlusion and venous occlusion
Cystoid macular edema	Diabetic retinopathy
Glaucoma	

Importantly, astaxanthin appears to be a potent way to both prevent and treat ARMD, which is the most common cause of blindness among the elderly. As previously reported by Life Extension Magazine:[13]

> *"The human retina naturally contains the carotenoids lutein and zeaxanthin, molecules closely related to astaxanthin. Supplementation with all three carotenoids (astaxanthin 4 mg/day, lutein 10 mg/day, zeaxanthin 1 mg/day) has been shown to improve visual acuity and contrast detection in people with early age-related macular degeneration.*[14]

> *In laboratory studies, astaxanthin supplementation protects retinal cells against oxidative stress and significantly reduces the area of destructive new blood vessel growth on retinas, a hallmark of advanced macular degeneration.*[15,16] *Studies of patients with age-related macular degeneration reveal significant improvements in retinal electrical outputs following supplementation with astaxanthin and other carotenoids.*[17]
>
> *Glaucoma, an increase in the pressure of fluid inside the eyeball, eventually results in retinal cell death from oxidant damage and loss of blood flow. Astaxanthin restores retinal parameters to normal in eyes with experimentally-induced glaucoma."*[18]

Since astaxanthin is far more powerful an antioxidant than both lutein and zeaxanthin, many researchers believe it to be the most effective antioxidant ever discovered for eye health.[19,20]

Specifically, astaxanthin has been shown to ameliorate or prevent light-induced damage, photoreceptor cell damage, ganglion cell damage and damage to the neurons of the inner retinal layers. Astaxanthin also helps maintain appropriate eye pressure levels that are already within the normal range, and supports your eyes' energy levels and visual acuity.

Anticancer Effects Exerted by Astaxanthin

More recent studies have also delved into astaxanthin's effects on cancer. Both in vivo and in vitro preclinical antitumor effects have been demonstrated in various cancer models. According to a study published in 2015, astaxanthin:[21]

> *"… exerts its anti-proliferative, anti-apoptosis and anti-invasion influence via different molecules and pathways including signal transducer and activator of transcription 3 (STAT3), nuclear factor kappa-light-chain-enhancer of activated B cells (NF-κB) and peroxisome proliferator-activated receptor gamma (PPARγ).*

> *Hence, [astaxanthin] shows great promise as chemotherapeutic agents in cancer."*

In animal studies, astaxanthin has been shown to:[22]

- Reduce the growth of transplanted mammary tumors
- Suppress liver carcinogenesis
- Inhibit potentially tumor-promoting polyamines in skin following UVA and UVB exposure (thereby reducing risk of skin cancer)
- Reduce incidence and proliferation of chemically-induced cancer of the urinary bladder, oral cavity and colon

Some of the proposed mechanisms of action include antioxidant activity, immune function enhancement and gene expression regulation. Also, as noted by Cyanotech in its "Astaxanthin and Cancer Chemoprevention" paper:[23]

> *"Effective cell-[to]-cell communication through gap junctions is deficient in many human tumors, and its restoration tends to decrease tumor cell proliferation. Several retinoids and carotenoids are now known to enhance gap junctional communication between cells ... This stimulation of gap junctional communication occurs as a result of a dose-dependent increase in the connexin 43 protein, via up-regulation of the connexin 43 gene."*

Astaxanthin Offers a Cornucopia of Health Benefits

Astaxanthin is likely one of the most useful supplements available, capable of tackling and preventing a host of health problems. It's one I regularly take and one I would not want to be without.

If you decide to give astaxanthin a try, I recommend starting with 4 mg per day, and working your way up to about 8 mg per day — or more if you're an athlete or suffering from chronic inflammation. Taking your astaxanthin supplement with a small amount of healthy fat, such as butter, coconut oil, MCT oil or eggs, will optimize its absorption.

Krill oil supplements also contain high quality animal-based omega-3 fat in combination with naturally-occurring astaxanthin, albeit at lower levels than what you'll get from an astaxanthin supplement. Different krill products have varying concentrations of astaxanthin, so check your label.

Sources and References

- [1] Food and Chemical Toxicology 2013 Jun;56:450-8
- [2] Molecular Nutrition and Food Research 2011 Jan: 55(1):150-65
- [3] Doctormurray.com, The Whole Body Benefits of Natural Astaxanthin
- [4] Huffington Post April 30, 2013
- [5] Examine.com, Astaxanthin Research
- [6] Food and Function 2014 Sep;5(9):1994-2003
- [7] Experimental Dermatology 2014 Mar;23(3):178-83
- [8] Photodermatol Photoimmunol Photomed. 2008 Jun;24(3):134-41
- [9] Stem Cell Res Ther. 2017; 8: 7
- [10] Scientific Reports 2017; 7, article number: 41440
- [11] Health Research & Studies Center, Los Altos, CA, Effect of daily use natural astaxanthin on C-reactive protein (PDF), January 31, 2006
- [12] Cyanotech, Neuroprotective Effects of Astaxanthin (PDF)
- [13] Lifeextension.com, Astaxanthin, April 2013
- [14] Eur J Ophthalmol. 2012 Mar-Apr;22(2):216-25
- [15] Invest Ophthalmol Vis Sci. 2008 Apr;49(4):1679-85
- [16] J Pharm Pharmacol. 2008 Oct;60(10):1365-74
- [17] Ophthalmology 2008 Feb;115(2):324-333.e2
- [18] Regul Toxicol Pharmacol. 2010 Oct;58(1):121-30
- [19] Pure Appl. Chem., Vol. 71, No. 12, pp. 2253±2262, 1999 (PDF)
- [20] Journal of the Science of Food and Agriculture May 1, 2001: 81(6); 559-568
- [21] Marine Drugs 2015 Jul; 13(7): 4310–4330
- [22, 23] Cyanotech, Astaxanthin and Cancer Chemoprevention (PDF)