

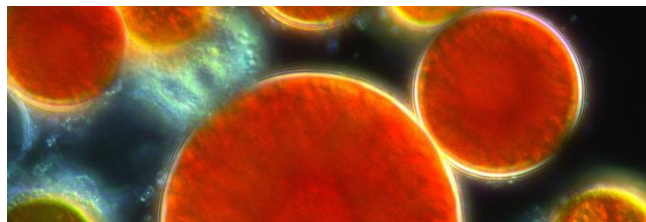
Astaxanthin:

Selected Bibliography of Functional Health Benefit Studies

Compiled by
Solix Algreidents, Inc.



[Astaxanthin](#) is a naturally occurring dark red carotenoid pigment found in aquatic animals such as salmon, trout, krill, shrimp, crayfish and crustaceans. It is a potent antioxidant and provides a broad range of health benefits.



Animals, such as salmon, lobster, shrimp and trout, acquire astaxanthin by consuming mainly algae directly or via other marine creatures. Since humans and other mammals cannot synthesize astaxanthin, they consume this valuable nutrient from seafood or a dietary supplement. (Source: Natural Algae Astaxanthin Association). The ubiquitous fresh water microalga, *Haematococcus pluvialis*, is the richest natural source of astaxanthin and is used in the production of Solasta® Astaxanthin.



Algal astaxanthin's benefits are well-established through extensive research and clinical studies. For easy reference, Solix Algreidents has compiled this third-party research bibliography.

Provides Antioxidant Protection

Benefit Summary

Astaxanthin delivers more potent antioxidant activity than other antioxidants such as beta-carotene, lutein, alpha-tocopherol or vitamin E (Shimidzu, *et al.*, 1996), and vitamin C.

What's even more unique is the fact that astaxanthin, unlike other carotenoids such as beta-carotene, remains an effective antioxidant as it counteracts the effects of free-radicals, and rarely, if ever, becomes a harmful pro-oxidant (Martin *et al.*, 1999).

Research

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Nobuyoshi Shimidzu, Masafumi Goto, and Wataru Miki. (1996) [Carotenoids as singlet oxygen quenchers in marine organisms](#). *Fisheries Science.* 62(1):134-137.

Eiji Yamashita (2015) [Let astaxanthin be thy medicine](#). *Pharma Nutrition*. In Press. Available online September 9, 2015.

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Supports Eye Health

Benefit Summary

Astaxanthin has been shown to support optimal eye health.

In clinical trials, astaxanthin alleviated eye fatigue and eyestrain (Kajita, *et al.*, 2009), especially for those who are in front of a computer screen all day (Nagaki, *et al.*, 2002). It also appeared to relieve the oxidative stress which could lead to inflammation and/or premature aging of eye tissue (Izumi-Nagai, *et al.*, 2008).

Research - Aids with the alleviation of eye fatigue

Masayoshi Kajita, Hiroki Tsukahara, Mio Kato. (2009) [The effects of a dietary supplement containing astaxanthin on the accommodation function of the eye in middle-aged and older people](#). *Medical Consultation and New Remedies*. 46(3):89-93.

Nagaki, Y., Hayasaka, S., Yamada, T., Hayasaka, Y., Sanada, M., and Uonomi, T. (2002) [Effects of astaxanthin on accommodation, critical flicker fusion, and pattern visual evoked potential in visual display terminal workers](#). *Journal of Traditional Medicines*. 19(5):170-173.

Nanako Takahashi and Masayoshi Kajita. (2005) [Effects of astaxanthin on accommodative recovery](#). *Journal of Clinical Therapeutics and Medicines*. 21(4) 431-436.

Research – Helps alleviate damaging free radicals, inflammation and aging of the eye

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Chitchumroonchokchai, C., Bomser, JA., Gamm, JE., and Failla, ML. (2004) [Xanthophylls and alpha-tocopherol decrease UVB-induced lipid peroxidation and stress signaling in human lens epithelial cells](#). *J. Nutr.* 134(12):3225-3232.

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Suzuki, Y., Ohgami, K., Shiratori, K., Jin, XH., Ilieva, I., Kyama, Y., Yazawa, K., Yoshida, K., Kase, S., and Ohno, S. (2006) [Suppressive effects of astaxanthin against rat endotoxin-induced uveitis by inhibiting the NF-kappaB signaling pathway](#). *Exp. Eye Res.* 82(2):275-281.

Supports Skin Health and Improves Appearance

Benefit Summary

Astaxanthin promotes/supports skin health and may reduce the signs of aging.

A clinical study involving women (who supplemented their diet with 6 mg/day astaxanthin as well as applied 1 ml of 0.094% astaxanthin solution made from a 5% astaxanthin oleoresin topically twice daily for eight weeks) found improvements in overall skin appearance, including reduction in wrinkles, crow's feet, age spots, under-eye swelling, flakes and acne blemishes (Tominaga, *et al.*, 2012).

These cosmetic effects are in addition to astaxanthin's protective benefits against photo-aging via inhibition of damaging oxidation and free-radical production caused by normal everyday outdoor exposure (Yoon, *et al.*, 2014).

Research

Kumi Tominaga, Nobuko, Hongo, Mariko, Karato, and Eiji Yamashita. (2012) [Cosmetic benefits of astaxanthin on human subjects](#). *Acta Biochimica Polonica*. 59(1):43-47.

Yoon, H.S., Cho, H.H., Cho, S., Lee, S.R., Shin, M.H., and Chung, J.H. (2014) [Supplementing with dietary astaxanthin combined with collagen hydrolysate improves facial elasticity and decreases matrix metalloproteinase-1 and -12 expression: a comparative study with placebo](#). *J. Med. Food*. 17(7):810-816.

Pamela Chávez-Crooker, Johanna Obreque, Jeanette Vera, and Karla Moya. (2011) [Chapter 9: Role of astaxanthin in cosmeceutical applications](#). Se-Kwon Kim [Ed] In: *Marine Cosmeceuticals: Trends and Prospects*. Pp. 119-124.

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Helps Maintain Cardiovascular Health

Benefit Summary

Astaxanthin helps maintain cardiovascular health.

Reduction of blood pressure, vascular inflammation, oxidative stress, and decrease of arterial stiffness are all important contributors to maintaining cardiovascular health.

Positive effects of astaxanthin supplementation were observed in studies of animal models for hypertension and stroke where research showed that arterial blood pressure was significantly reduced and neurological performance was maintained (Hussein, *et al.*, 2005).

In a human clinical study, patients who supplemented their diet with 6 mg/day astaxanthin for 10 days were found to have improved blood flow (Miyawaki, *et al.*, 2008), which may explain the anti-hypertension effects of astaxanthin.

All of these effects together reinforce the potential of dietary supplementation of astaxanthin supporting cardiovascular health in humans (Hussein, *et al.*, 2006).

Research

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Yoshimi Kishimoto, Mariko Tani, Harumi Uto-Kondo, Maki Iizuka, Emi, Saita, Hirohito Sone, Hideaki Kurata and Kuzo Kondo. (2010) [Astaxanthin suppresses scavenger receptor expression and matrix metalloproteinase activity in macrophages](#). *European Journal of Nutrition.* 49(2):119-126.

Supports a Balanced Immune System

Benefit Summary

Astaxanthin supports/promotes a balanced immune system and may mitigate the effects of inflammation.

Many disease conditions are a result of improper functioning of our immune system.

Supplementing the diet with 8 mg/day astaxanthin for eight weeks was shown in a randomized double-blind, placebo-controlled study to significantly decrease oxidative stress, DNA damage, and inflammation while enhancing immune response in female subjects (Park, *et al.*, 2010).

In *in vitro* (Lee, et al., 2003) and *in vivo* (Ohgami, et al., 2003) studies, astaxanthin was found to significantly reduce the production of various mediators that could lead to inflammation.

Research

Jean Soon Park, Jong Hee Chyun, Yoo Kyung Kim, Larry L Line, and Boon P Chew. (2010) [Astaxanthin decreased oxidative stress and inflammation and enhanced immune response in humans](#). *Nutrition and Metabolism*. 7(8):1-10.

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Kazuhiro Ohgami, Kenji Shiratori, Satoshi Katoke, Tomomi Nishida, Nobuhisa Mizuki, Kazunaga Yazawa, Shigeaki Ohno. (2003) [Effects of astaxanthin on lipopolysaccharide-induced inflammation in vitro and in vivo](#). *Physiology and Pharmacology*. 44:2694-2701.

Improves Exercise Endurance and Muscle Recovery

Benefit Summary

Astaxanthin shows promise as a sports performance dietary supplement for athletes.

Improvement of exercise endurance and power output was demonstrated in cyclists who supplemented their diet with 4 mg/day astaxanthin for four weeks. Cycling trial times were significantly decreased indicating improved endurance. Additionally, power output was increased by an average of 15% (Earnest, *et al.*, 2011).

Another study linking astaxanthin to improved athletic performance reported improved immune system response, reduced oxidative stress, and reduced muscle damage and inflammation in muscle tissues in a trial with young soccer players who had supplemented their diet with 4 mg/day astaxanthin for 90 days (Baralic, *et al.*, 2015).

Research

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Sawaki, K., Yoshigi, H., Aoki, K., Koikawa, N., Azumane, A., Kaneko, K., Yamaguchi, M. (2002) Sports performance benefits from taking natural astaxanthin characterized by visual acuity and muscle fatigue improvements in humans. *J. Clin. Ther. Med.* 18(9):73-88.

Aoi, W. Naito, Y., Sakuma, K., Kuchide, M., Tokuda, H., Maoka, T., Toyokuni, S., Oka, S, Yasuhara, M., and Yoshikawa, T. (2003) [Astaxanthin limits exercise-induced skeletal and cardiac muscle damage in mice](#). *Antioxidants and Redox Signaling*. 5(1):139-144.

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