

Astaxanthin-A Glimmer of Hope for Good Health

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Introduction

Astaxanthin is a vibrant red coloured xanthophyll carotenoid naturally found in various seafood such as sockeye salmon, trout, sea bream, crabs and shrimps. *Haematococcus pluvialis*, microalgae, is the foremost and richest commercial source for natural Astaxanthin. However, it cannot be synthesized by animals and must be provided in the diet. Humans can include astaxanthin in their diet by consuming Astaxanthin containing seafood or dietary supplements, either synthetic or extracted from *Haematococcus pluvialis* [1-5].

Astaxanthin has a unique structure due to the presence of a keto and hydroxyl on each end of the molecule which contributes to the enhanced antioxidant property. It has strong free radical scavenging activity and protects against lipid peroxidation and oxidative damage of LDL-cholesterol, cell membranes, cells, and tissues. It is 550 times stronger than vitamin E, and 6,000 times stronger than vitamin C. Recent studies have shown decreased DNA damage and enhanced immune response in human subjects consuming Astaxanthin [6,7].

It is a cut above the other carotenoids as it is lipid soluble, increases the span of cell membranes, protects the cellular and mitochondrial membranes and ocular tissues against oxidative damage, has bonding capacity with muscle tissue and is a potent absorber of the UVB rays and acts as a natural sunscreen. A study carried out by Karppi [8] on healthy male subjects, showed that daily consumption of 4mg Astaxanthin for 3 months lowered the plasma levels of peroxidized lipids, including 12- and 15-hydroxy fatty acids. This indicates that Astaxanthin inhibit lipid peroxidation.

Astaxanthin suppresses the synthesis of inflammatory mediators such as tumor necrosis factor alpha, prostaglandins, leukotriens and interleukins, nitric oxide, cyclooxygenase-1 and -2 (COX-1 and COX-2) enzymes and interleukin-1B. Therefore, it can help in the prevention and treatment of inflammatory conditions such as rheumatoid arthritis, tennis elbow, carpal tunnel syndrome and other repetitive stress injuries [5,9].

Miyachi et al. [10] conducted a study to evaluate the anti-inflammatory effects of astaxanthin on chronic inflammatory lesions of oral lichen planus and found that administration of

astaxanthin suppresses the inflammation by protecting the biomembrane prior to stimulation which results in increased cell proliferation at early stages. The inflammatory mediators which have already acted on the biomembrane are suppressed by the curative doses of astaxanthin. Thus, astaxanthin may prove useful in the chronic inflammation associated with oral lichen planus [10].

Yuce et al. [11] evaluated the effects of astaxanthin on alveolar bone loss in their experimental study on rats and found that astaxanthin acts by increasing the osteoblastic activity and decreasing the osteoclastic activity, thus, reducing the alveolar bone loss in periodontitis.

Astaxanthin showed significant antitumor activity as compared to other carotenoids like canthaxanthin and β -carotene [12,13]. Administration of astaxanthin before tumour initiation in experimental mice showed that it increases the level of natural killer cells in blood and gamma interferon in plasma conferring a protective effect. Astaxanthin plays a crucial role in the suppression of tumour invasion and tumour progression. An earlier study showed that astaxanthin (15mg/kg of body weight/orally) taken in colon cancer showed lower tumour size and reduced levels of tumour biomarkers. It has been found beneficial in the inhibition of the growth of fibrosarcoma, breast, and prostate cancer cells and embryonic fibroblasts [14].

Astaxanthin in oral carcinogenesis, premalignant lesions like leukoplakia and conditions like oral submucous fibrosis needs further investigation owing to the unique structural properties and lack of pro-oxidant activity [15].

Dore [15] carried out in vitro studies in humans and concluded that more research is needed on the absorption and metabolism of these promising anticancer agents and on its interaction with other carotenoids and vitamins in the human system [16].

Astaxanthin helps immune-system mechanism by acting against free radicals. Jyonouchi [17], in his study on a mouse model, concluded that astaxanthin has higher immunomodulating effects as compared to β -carotene [17,18]. It is also used routinely in the treatment of diabetes mellitus and hypertension.



Thus, the immunomodulatory, antioxidative, and anti-inflammatory and chemopreventive properties of astaxanthin, a bioactive natural supernutrient carotenoid, can cast its shadows for preventing a myriad of diseases and maintenance of optimum health in futurity [17-22].

References

1. Tan FY (2012) The silver bullet for cancer prevention: Chemopreventive effects of carotenoids. *Bio Medicine* 2(3): 117-121.
2. Biswal S (2014) Oxidative stress and astaxanthin: The novel supernutrient carotenoid. *International Journal of Health & Allied Sciences* 3(3): 147-153.
3. Zhang L, Wang H (2015) Multiple mechanisms of anti-cancer effects exerted by astaxanthin. *Mar Drugs* 13(7): 4310-4330.
4. Ambati R, Phang SM, Ravi S, Aswathanarayana RG (2014) Astaxanthin: sources, extraction, stability, biological activities and its commercial applications-a review. *Mar Drugs* 12(1): 128-152.
5. Bhattacharjee M (2014) Algal Astaxanthin- A potent molecule for good health. *J Algal Biomass Utln* 5(4): 21-28.
6. Fassett RG, Coombes JS (2011) Astaxanthin: A potential therapeutic agent in cardiovascular disease. *Mar Drugs* 9(3): 447-465.
7. Terazawa S, Nakajima H, Shingo M, Niwano T, Imokawa G, et al. (2012) Astaxanthin attenuates the UVB-induced secretion of prostaglandin E2 and interleukin-8 in human keratinocytes by interrupting MSK1 phosphorylation in a ROS depletion-independent manner. *Exp Dermatol* 21(Suppl 1): 11-17.
8. Karppi J, Rissanen TH, Nyssönen K, Kaikkonen J, Olsson AG, et al. (2007) Effects of astaxanthin supplementation on lipid peroxidation. *Int J Vitam Nutr Res* 77(1): 3-11.
9. Kim JH, Chang MJ, Choi HD, Youn YK, Kim JT, et al. (2011) Protective effects of *Haematococcus* astaxanthin on oxidative stress in healthy smokers. *J Med Food* 14(11): 1469-1475.
10. Miyachi M, Matsuno T, Asano K, Mataga I (2015) Anti-inflammatory effects of astaxanthin in the human gingival keratinocyte line NDUSD-1. *J Clin Biochem Nutr* 56(3): 171-178.
11. Yuce BH, Alpan AL, Gevrek F, Toker H (2017) Investigation of the effect of astaxanthin on alveolar bone loss in experimental periodontitis. *J Periodontal Res* doi: 10.1111/jre.12497.
12. Choi HD, Kim JH, Chang MJ, Kyu-Youn Y, Shin WG, et al. (2011) Effects of astaxanthin on oxidative stress in overweight and obese adults. *Phytother Res* 25(12): 1813-1818.
13. Chew BP, Park JS (2004) Carotenoid action on the immune response. *J Nutr* 134(1): 257S-261S.
14. Chew BP, Park JS, Wong MW, Wong TS (1999) A comparison of the anticancer activities of dietary β -carotene, canthaxanthin and astaxanthin in mice *in vivo*. *Anticancer Res* 19(3A): 1849-1853.
15. Dore JE (2005) Astaxanthin and cancer chemoprevention. In: Bagchi D, Preuss HG (Eds.), *Phytopharmaceuticals in Cancer Chemoprevention*. CRC Press, Boca Raton, Florida, USA, pp. 555-557.
16. Tanaka T, Makita H, Ohnishi M, Mori H, Satoh K, et al. (1995) Chemoprevention of rat oral carcinogenesis by naturally occurring xanthophylls, astaxanthin and canthaxanthin. *Cancer Res* 55(18): 4059-6404.
17. Palozza P, Torelli C, Boninsegna A, Simone R, Catalano A, et al. (2009) Growth-inhibitory effects of the astaxanthin-rich alga *Haematococcus pluvialis* in human colon cancer cells. *Cancer Lett* 283(1): 108-117.
18. Jyonouchi H, Hill R, Tomita Y, Good R (1991) Studies of immunomodulating actions of carotenoids. I. Effects of β -carotene and astaxanthin on murine lymphocyte functions and cell surface marker expression in *in vitro* culture system. *Nutr Cancer* 16(2): 93-105.
19. Lim S, Lee JY, Jung WH, Lim EH, Joo MK, et al. (2011) Anticancer Effects of Astaxanthin and α -tocopherol in Esophageal Cancer Cell Lines. *The Korean Journal of Helicobacter and Upper Gastrointestinal Research* 11(3): 170-175.
20. Baralic I, Andjelkovic M, Djordjevic B, Dikic N, Radivojevic N, et al. (2015) Effect of astaxanthin supplementation on salivary IgA, oxidative stress, and inflammation in young soccer players. *Hindawi publishing corporation evidence-based complementary and alternative medicine* 2015(2015): 1-9.
21. Andrisani A, Donà G, Tibaldi E, Brunati AM, Sabbadin C, et al. (2015) Astaxanthin improves human sperm capacitation by inducing Lyn displacement and activation. *Mar Drugs* 13(9): 5533-5551.
22. Donà G, Kožuh I, Brunati AM, Andrisani A, Ambrosini G, et al. (2013) Effect of astaxanthin on human sperm capacitation. *Mar Drugs* 11(6): 1909-1919.