

# Astaxanthin-A Glimmer of Hope for Good Health

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**Submission:** 📅 August 17, 2017; **Published:** 📅 November 30, 2017

## 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  $\beta$ -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  $\beta$ -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].

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