

## Lifestyle & Culture

# Crustacea against cancer and its health benefits – Astaxanthin



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### Introduction

Belonging to the group of naturally occurring pigments known as carotenoids, Astaxanthin is known for the red or pink colour it gives to the many species in which it is found. In particular, Astaxanthin is present in the marine environment and its reddish pigment is easily observed in aquatic animals including salmon, trout, lobster and shrimp.

Astaxanthin is proven to provide a wide range of health benefits to the human body. These include cardiovascular diseases, neurological disorders, ophthalmic diseases, dermatological diseases, bone diseases, immunological diseases and obstetric and oncological conditions.

### Cardiovascular diseases

Astaxanthin is found to have a beneficial effect when it comes to cardiovascular diseases. The formation of atheromatous plaque, which is an accumulation of cholesterol within the arteries, a condition known as atherosclerosis, causes the arteries to narrow hence reducing and obstructing the blood flow to vital organs in the human body.

### Immunological diseases

The immune system of humans is made up of cells that defend the human body against infection while protecting the body's own cells. These cells are extremely sensitive when there is an insult to the human body and respond by mounting an immune response to protect the human body from invaders that are harmful. In fact, astaxanthin is found to improve the immune system of the human body.

### Skin cancer

The main risk factor of skin cancer is prolonged exposure to ultraviolet radiation. Ultraviolet radiation is part of the natural energy produced by the sun. Ultraviolet radiation is proven to cause basal cell carcinoma (BCC) and squamous cell carcinoma (SCC). In fact, astaxanthin is proven to have a beneficial effect in the treatment of skin cancers and melanomas and this has been attributed to its capability to suppress the Programmed Death Ligand 1 protein which is common in cancer. The Programmed Death Ligand 1 protein enables cancer cells to hide from the immune system. This makes astaxanthin an effective natural immunotherapy against skin cancer. Considering astaxanthin is natural there are no side effects.



AI-generated images created by Prof. Blundell

In addition, astaxanthin can be used both orally and topically (on the skin) to treat basal cell carcinoma and squamous cell carcinoma. Furthermore, astaxanthin is also an effective anti-ageing supplement and research has shown that it can reduce fine lines and wrinkles, hence giving the skin a more youthful appearance.

### Physical activity and lifestyle

Research has shown that athletes are found to have elevated levels of free radicals in their blood, low levels of antioxidants and build-up of lactic acid causing burning in the muscles, fatigue, reduced muscle endurance and hence reduced overall exercise performance. This occurs specifically during heavy exercise without sufficient supplementation of antioxidant support. In fact, astaxanthin, which acts as an antioxidant, is found to neutralize free radicals and reactive oxygen species and thus reduces muscle fatigue, improves muscle endurance and strength, and improves overall exercise performance. Recent research has shown that astaxanthin treatment increased the decrease of body fat accumulation with exercise training, the results concluded that astaxanthin promotes the metabolism of lipids rather than glucose utilization

during exercise, leading to improvement of overall exercise endurance and efficient reduction of adipose tissue with exercise.

### Bone diseases

Moreover, astaxanthin is a potent anti-inflammatory, making it important for healthy bone. It is found that chronic inflammation can reduce the density of bones leading to osteoporosis, which is characterised by a reduction of the bone mineral density of the bone, which can lead to bone fragility and fracture.

### Ophthalmic diseases

Astaxanthin is also beneficial to eye health and offers protection against common eye diseases including cataracts, age-related macular degeneration and eye strain and fatigue. Astaxanthin is beneficial to the eye health of the individual because it prevents cataracts from forming in an individual. In addition, astaxanthin is also beneficial to an eye condition known as Age-Related Macular Degeneration. In fact, the supplementation of astaxanthin provides a protective effect against macular degeneration. In addition, astaxanthin is also found to protect against light-induced retinal damage. Furthermore, astaxanthin can be used for eye

strain and fatigue. Any activity which requires intense eye use can result in eye strain and discomfort.

### Neurological diseases

Furthermore, astaxanthin is also used in neurological conditions including Huntington's disease, Parkinson's disease, Alzheimer's disease and amyotrophic lateral sclerosis known as ALS. The fact that astaxanthin is a fat-soluble compound, which means that it can pass easily through the blood-brain barrier and reach the brain, means that it can be beneficial for the treatment of neurological diseases. The supplementation of astaxanthin is found to maintain and improve cognitive function.

### The role of Astaxanthin in cancer therapy

Astaxanthin is found to have growth inhibitory effects and these were demonstrated in several tumour cells such as oral fibrosarcoma, prostate cancer and breast and colon cancer. Astaxanthin is crucial for the inhibition of oxidative molecules. Moreover, astaxanthin is found to inhibit the proliferation of cells, induction of cell apoptosis and interfere with the progression of the cell cycle.

Astaxanthin plays a crucial role in the process of inflammation by having anti-inflammatory properties. Inflammation is a series of im-

mune responses that are initiated when the body suffers from an injury to begin the process of tissue repair. Astaxanthin is found to inhibit the occurrence of inflammatory mucosal ulcers. This led to the prevention of adenocarcinoma in the colon. The spread of cancer to other sites such as organs and bone (metastasis) occurs when cancer cells break away from the original tumour. Astaxanthin appears to support and enhance this form of cell-to-cell communication, which means it may be beneficial against a variety of different types of cancer. In fact, astaxanthin is found to enhance gap-junction communication, and this enhanced communication has been shown to inhibit cancer formation and growth.

Research indicates that astaxanthin is beneficial to several types of cancers in humans including oral, lung, liver, colorectal and prostate. In oral cancer, astaxanthin is found to prevent the signalling pathways involved in the proliferation and spread of oral cancer by reducing the ability of tumour cells to create new blood vessels to sustain or fuel its growth. In liver cancer, especially human hepatocellular carcinoma, astaxanthin is found to induce a high level of cell death hence concluding that astaxanthin is potentially useful in combatting hepatocellular carcinoma. In lung cancer, astaxanthin is found to reduce the viability of the cancer cells and decreased the production of proteins associated with chemotherapy resistance. In addition, evidence has shown that when astaxanthin was combined with anti-cancer drug known as mitomycin C, the viability of the cancer cells decreased more, and the death of cancer cells increase further hence improving the outcome and the effectiveness of treatment. In colorectal cancer, astaxanthin has shown an increase in the process of apoptosis, which is a programmed cell death and a decrease in the expression of proteins which is consistent with inflammatory process. In prostate cancer, which is one of the most common cancers in men, the use of astaxanthin has shown that the tumour volume and the tumour weight was significantly reduced.

Finally, astaxanthin has shown that it possesses diverse properties that are beneficial to humans that could play a significant role in the treatment of several health conditions and cancer.

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