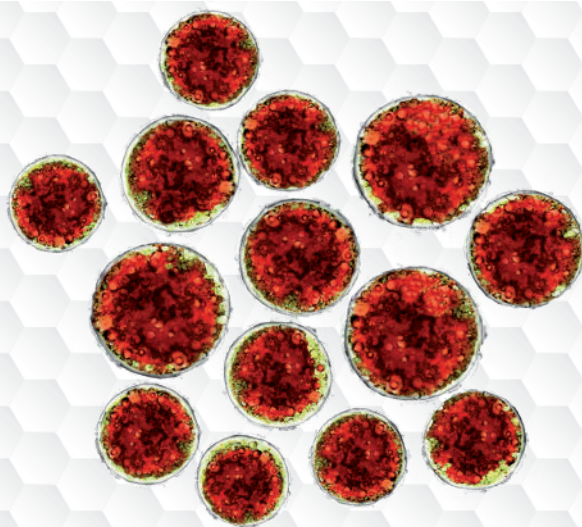


Natural Astaxanthin

The positive effects of algae-based astaxanthin on your muscle health and performance



Executive summary

A supplementary diet with natural astaxanthin, derived from the microalga *Haematococcus pluvialis* has proven several positive effects on the human body. The subsequently presented studies indicate that astaxanthin might as well be beneficial for muscle health, especially during physical exercise.

Benefits of natural astaxanthin for the muscle health and performance:

- Improves strength/endurance and muscle size
- Attenuates muscle damage
- Prevents inflammation
- Decreases muscle fatigue

Introduction

During periods of heavy physical exercise and competition, the human body increases the production of free radicals and reactive oxygen species (ROS). Although ROS is vital for several functions of the human body, an imbalance, known as oxidative stress, can damage proteins, lipid and DNA. As a result of the overproduction of ROS, muscle damage, soreness and fatigue can cause inflammation which might decrease muscle performance. Since astaxanthin is the strongest antioxidant, several studies were conducted to research the impact of an astaxanthin-supplemented diet during physical exercise.^[2]

In the following, recent studies on the potential benefits of an astaxanthin-supplemented diet for the health and better performance of the human muscle system are presented.

What is the power of natural astaxanthin

Astaxanthin is a naturally occurring pigment that gives the reddish color to marine organisms such as crabs, shrimps and salmons. Chemically, astaxanthin belongs to the carotenoid group, specifically to the xanthophylls. In natural surroundings, it can be found in photosynthetic organisms like bacteria, algae and yeasts. The highest concentrations of natural astaxanthin can be accumulated from the sweet water microalga *Haematococcus pluvialis*. Due to its unique molecular structure, astaxanthin contains both lipophilic and hydrophilic properties, and it can combine with cell membranes from inside and outside.^[1]

Natural astaxanthin has great anti-inflammatory effects. Furthermore, it is considered to be the most powerful antioxidant and highly effective at counteracting reactive oxygen species (ROS). It neutralizes harmful free radicals in a way that does not harm somatic cells. Unlike other antioxidants, astaxanthin does not become a pro-oxidant which can harm the body. Compared to other well-established synthetic or natural antioxidants, natural astaxanthin has been proven to be significantly more effective. Therefore, it is also called the “diamond of radical scavengers” (for details, see our dossier “Natural astaxanthin – nature’s most powerful antioxidant”).

Natural astaxanthin is classified as a novel food in the European Union and was considered safe by the United States Food and Drug Administration (FDA) with GRAS (generally recognized as safe) status. Numerous scientific studies have demonstrated the positive effects of natural astaxanthin on human health.

Human clinical studies

A Swedish double-blind, placebo-controlled study from 2008, with 40 healthy male students between the ages of 17 and 19, showed positive effects of astaxanthin supplementation on muscle endurance and strength. The participants were split into two groups and received one capsule of 4mg astaxanthin or a placebo each day over six months. Participant strength/endurance was determined before and after the supplementation as was the maximum number of knee bends in a training machine. The increase within the astaxanthin group was significantly higher (three times) compared to the control group after six months of supplementation (figure 1). The authors concluded that this could not be explained by improved fitness or muscle growth but suggested that astaxanthin supplementation effects improved strength/endurance.^[3]

In a different study published in 2012, the effects of natural astaxanthin supplementation on young soccer players were tested. The 60 young and healthy participants were split into two groups and given one capsule of 4mg natural astaxanthin or a placebo over a period of 90 days. Performance of the athletes was measured before and after the supplementation. The astaxanthin group showed an increase in running speed and running time to exhaustion compared to the values at baseline. Besides the performance boost, the astaxanthin group also showed an increase in the blood level of creatine kinase, which is used as an indicator for muscle fatigue. The study authors pointed out that astaxanthin supplementation can therefore “attenuate exercise-induced muscle damage to some extent” and “could prevent exercise-induced free radical production.”^[4]

The same research team examined further benefits due to astaxanthin supplementation in a different study, again with soccer players, in 2015. Over 90 days, the 40 soccer players were given 4mg of astaxanthin or a placebo. Salvia and blood samples were taken at the beginning and after 90 days in pre-exercise conditions. The study revealed a significant increase in immunoglobulin A (IgA) concentration in the astaxanthin group compared to the control group.

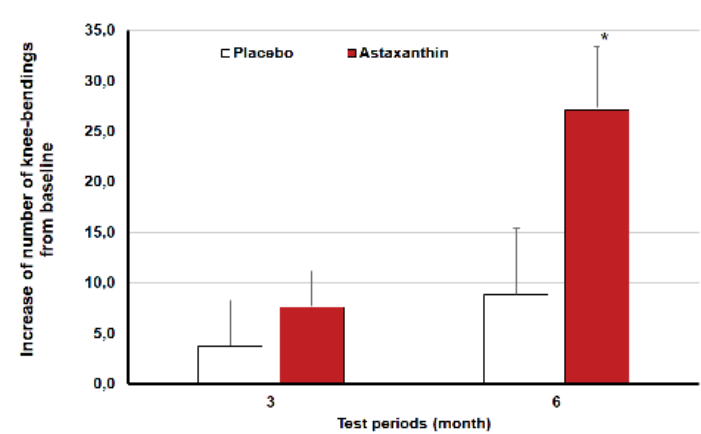


Figure 1: Increased number of knee bends at baseline in both groups. *p=0.047 vs. placebo.^[3]

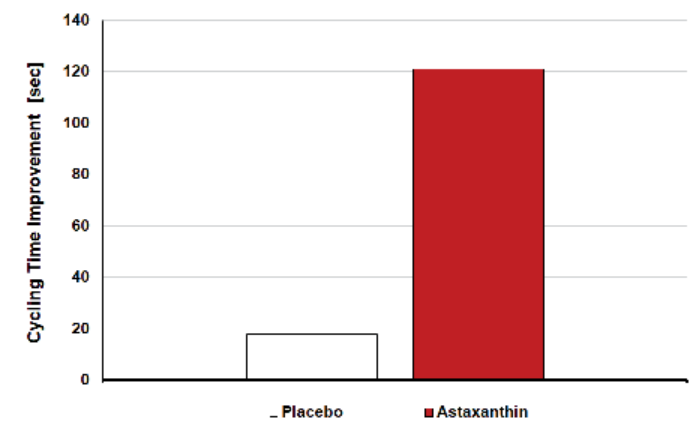


Figure 2: Improved time performance after 28 days of astaxanthin supplementation compared to the performance at baseline.^[6]

Immunoglobulin A is an antibody class that plays a key role in immune protection. Furthermore, the study showed a better prooxidant-antioxidant balance in the astaxanthin group. The study authors concluded that “astaxanthin supplementation improves IgA response and attenuates muscle damage, probably due to restoring redox balance, thus preventing inflammation induced by rigorous physical training.”^[5]

Another double-blind, placebo-controlled study from 2011 showed similar effects. In this study, effects of astaxanthin supplemented-diet on cycling time trial performance was tested on 21 amateur endurance-trained males from 18 to 39 years of age.

Over four weeks, the participants were given one capsule of 4mg astaxanthin or a placebo per day. In a 20km cycling time trial, the astaxanthin group performed significantly better compared to the placebo group at baseline (figure 2). After 28 days, the natural astaxanthin supplementation had improved the cyclists’ time 5% on average.^[6]

Besides, cyclists also showed a significant improvement in their power output. The astaxanthin group power output had increased by 20 Watt, which was an increase by 15% compared to their output at baseline (figure 3). The study authors concluded that “natural astaxanthin supplementation may be an effective supplement for improving exercise performance.”^[6]

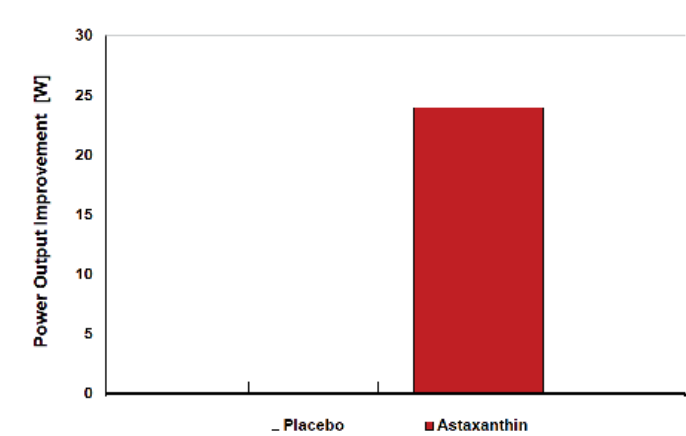


Figure 3: Improved power output in Watt after 28 days of astaxanthin supplementation compared to data at baseline.^[6]

A more recent study from 2018 showed that the benefits of astaxanthin supplementation for strength and endurance does not only apply to young people.

In this randomized, double-blind, placebo-controlled study, 42 elderly subjects (65 to 82 years) participated. Over 4 months, the subjects were given a natural formulation of 12mg astaxanthin, 10mg tocotrienol and 6mg zinc or a placebo each day. For three months, the participants trained three times a week with increasing intervals of incline walking. While both groups showed an increase in endurance and walking distance, only the astaxanthin group proved a significant increase in muscle strength and size compared to the performance at baseline (figure 4).^[7]

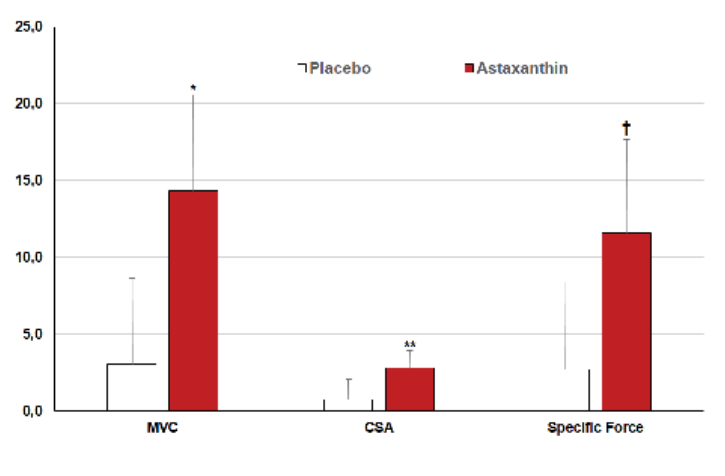


Figure 4: Changes in muscle properties after three months of training with astaxanthin- and placebo-supplemented elderly subjects. Maximum voluntary contraction (MVC), muscle cross-section area (CSA) and specific force (MVC/CSA) compared to performance at baseline.

*p<0.02, **p<0.01, † p=0.053 for paired 2-tailed test.^[7]

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BDI-BioLife Science (BLS) specializes in the development of innovative technologies to produce high-quality algal materials for the life sciences industry.

State-of-the-art in-house research facilities as well as years of cooperation with renowned universities create the basis for BDI's chief knowledge in algal research. Our department of product development turns ideas into finished formulations and supports you along the way from the raw material to the white label product. At the cultivation plant located at the Ökopark in Hartberg/Austria, BDI-BioLife Science produces algae with the specially developed, closed algae cultivation process to produce natural astaxanthin, tailor-made for the cosmetics (AstaCos®) and food supplement (astafit®) industries.



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