

Astaxanthin Study Shows Improved Lipid Metabolism or "Fat-Burn" Combined with Exercise

In the past, astaxanthin research had demonstrated improved muscle endurance, reduced lactic acid build-up, lowered membrane peroxidation and more. Currently, supplements containing astaxanthin are used by several world-class athletes from around the globe. New findings by Aoi et al., (2008) reveal an opening into the mechanism of action behind increased endurance and at the same time show new indications of enhanced fat metabolism in a mice model.

The most recent data published by the researchers from the Kyoto Prefectural University of Medicine, University of Shizuoka, University of Hyogo, and University of Nagoya revealed that astaxanthin protected the carnitine palmitoyl transferase I (CPT I) function in mitochondria in mice during intense physical activity (treadmill 30 m/minute). Furthermore, the astaxanthin treated group accelerated body fat reduction or "fat-burning" when combined with exercise compared to just exercise alone. The authors suggested enhanced lipid metabolism during physical activity may be the reason behind increased endurance and body fat reduction.

The CPT I is a lipid transport enzyme located on the mitochondrial membrane and it supplies lipids or "fuel" into the mitochondria for energy production. During intense physical activity muscle mitochondria produce high amounts of reactive oxygen species (ROS) that could lead to CPT I oxidation resulting in decreased function of lipid transport. The results showed that AstaREAL astaxanthin protected CPT I against ROS which subsequently allowed the continual transport of fats into the mitochondria for energy production ($p < 0.05$). Evidence include decreased CPT I modification by HEL lipid peroxide. ($p < 0.05$) and significantly increased colocalization of Fat/CD36 with CPT I ($p < 0.05$) on the mitochondrial membrane.

Fat utilization compared to carbohydrates was the predominant source of ATP energy according to the Respiratory Exchange Ratio (RER). Furthermore, plasma lactate was significantly increased by exercise, while this elevation was suppressed by astaxanthin in the diet ($P < 0.05$). As a result, the time to reach exhaustion significantly increased by 20% longer than the control group ($p < 0.05$). After 4 weeks of astaxanthin intake, the body weight and epididymal fat showed a significant decrease compared to the exercise control and sedentary groups.

This study is important because it showed that astaxanthin can modify muscle metabolism by its antioxidant property, resulting in improved muscle performance and weight loss benefits. Recent studies using astaxanthin in

endurance studies also point to the same findings by Aoi et al., 2008. In September 2007 at the 21st Annual Meeting on Carotenoid Research, Osaka , Japan; Professor Yazawa of Tokyo University of Marine Science and Technology presented similar findings of improved lipid metabolism with exercise on a diet with astaxanthin and high fat intake. Yazawa's research group has also published other papers on this subject. The relevant publications are Ikeuchi et al., 2006 Effects of astaxanthin supplementation on exercise-induced fatigue in mice and Ikeuchi et al., 2007 Effects of astaxanthin in obese mice fed a high-fat diet.

Reference: 2008 Aoi et al., Astaxanthin improves muscle lipid metabolism in exercise via inhibitory effect of oxidative CPT I modification. *Biochemical & Biophysical Research Communications* 36:892-897.