

Natural Astaxanthin and L-Carnitine for muscle health and strength

The exercising horse demands adequate intake of a nutritional diet to maintain its muscle strength and endurance. During exercise oxygen consumption increases significantly to maintain the energy demands of skeletal muscles. The increased oxygen consumption is accompanied by the release of reactive oxygen molecules that can lead to oxidative damage of skeletal muscle tissue, an effect that is further aggravated by the release of additional reactive oxygen species by immune cells involved in repairing damaged muscle tissue post-exercise¹. Increases in serum creatine kinase activity is a reliable indicator for exercise-induced muscle necrosis, also known as exertional rhabdomyolysis (ER) or “Tying-up Syndrome”^{2,3}.

How can we avoid Tying up?

ER is probably the most common muscle disorder found in horses and its onset may be caused by multiple factors, including overexertion,

dietary issues (high grain diet, electrolyte imbalance) or genetic predisposition^{4,5}. The question many horse owners and horse trainers are facing is, how can we minimize the risk of exertional rhabdomyolysis? Besides a well-designed conditioning exercise program, particular attention should be given to dietary factors, such as a well-balanced diet, sufficient electrolytes, and natural antioxidants aimed at reducing exercise-induced muscle damage. The antioxidant status in a horse plays an important role⁶ and

dietary supplementation with natural antioxidants will enhance the horse’s antioxidant status and minimize the risk of muscle injuries caused by oxidative stress. The vitamins C and E are widely used as feed supplements to improve the horse’s antioxidant status⁷.

Natural Astaxanthin – antioxidant of choice

In recent years another natural antioxidant, astaxanthin, has received a lot of attention because of its superior antioxidant qualities, its lack of pro-oxidant capabilities and its unique cellular mechanism to protect cells and mitochondria – the powerhouse of the cell – , from oxidative stress and damage^{8,9,10}. Astaxanthin is a carotenoid most

commonly found in marine animals like shrimp, lobster or salmon (astaxanthin makes the salmon flesh pink), but also in birds like flamingos. The organisms that really is at the beginning of the food chain is a tiny microalga called *Haematococcus Pluvialis*. This microorganism produces large amounts of astaxanthin as a protective measure against environmental conditions that trigger production of reactive oxygen molecules, including conditions of draught or strong sun exposure. When the algae are consumed by other animals like shrimp or salmon, the protective effects of astaxanthin are transferred to the next level in the food chain.

Astaxanthin protects the cell’s powerhouse, the mitochondria

Because astaxanthin can integrate across the entire thickness of the cellular and mitochondrial membrane bilayer, its antioxidant powers can protect against aggressive oxygen molecules from both inside and the outside the membrane boundary, unlike other antioxidants that work only inside or outside of a cell or mitochondria¹¹.

Emerging clinical research is continuously adding further strong evidence of the remarkable benefits of natural astaxanthin’s antioxidant and anti-inflammatory properties.



Numerous studies have demonstrated that daily supplementation with natural astaxanthin provides a wide range of health benefits in humans that include muscle strength and muscle endurance¹².

Astaxanthin supplementation reduces tying up episodes

More than 20 years ago, AstaReal conducted the first trial with horses experiencing frequent tying-up episodes and found that supplementation with AstaReal® natural astaxanthin for 2-3 weeks alleviated tying-up episodes; when supplementation was stopped, tying up episodes returned after 2 weeks.

Recent studies with AstaReal® natural astaxanthin added further evidence, showing the benefits natural astaxanthin can have for horses.

One study with thoroughbred race horses clearly showed that natural astaxanthin protected the muscles from exercise-induced muscle damage. Blood serum analysis from 24 thoroughbred horses revealed that the antioxidant capability of natural astaxanthin prevented the accumulation of serum creatine kinase activity, an indicator of muscle damage, in a dose-dependent manner¹³. This study built on earlier trials that suggested that dietary interventions and a wide variety of antioxidant supplements should be recommended for the management of horses with exercise-induced muscle damage^{14,15,16}. However, despite numerous studies testing different antioxidants, no effective supplementation strategy for the prevention of exercise-induced muscle damage had been established so far.

We know that the key to a horse's strength and endurance is efficient and continuous energy production by the cells' mitochondria. We already know that astaxanthin is protecting the mitochondrial membrane, but that alone isn't making the horse stronger or faster. Mitochondrial function together with the flow of nutrients, like sugar and fat, into mitochondria are determinants of energy production and endurance. Extensive research in animals has shown that astaxanthin enhances the transport of nutrients across the mitochondria membrane by protecting nutrient-carrying transporters (CPT-1) from damage by reactive oxygen species, ensuring a constant and efficient energy supply¹⁷. The transporter, CPT1, needs

L-Carnitine to efficiently transport fatty acids across the mitochondrial membrane where they can be metabolized into energy^{18,19}. Therefore, it makes sense to combine astaxanthin and L-Carnitine to optimize mitochondrial energy production in muscle. Trials with thoroughbred race horses showed improved protection from muscle damage and enhanced energy conversion when both nutrients were provided in the horses' daily diet²⁰. Horses that received a combination of astaxanthin and L-Carnitine showed significantly reduced creatine kinase activity and lower levels of another marker of acute or chronic muscle damage, lactate dehydrogenase.

Natural astaxanthin accelerates the healing process of damaged muscle tissue

Horses experiencing muscle damage from tying-up or exertional rhabdomyolysis will recover after rest and dietary intervention within a few weeks. However, the repair of damaged muscle tissue can lead to scarring that may affect the horse's strength and endurance in the long run. Two genes are essential for the muscle repair process: the gene Col1A1 carries the blueprint for the synthesis of the fibrillary collagen type 1 and bFGF encodes an important growth factor ("basic Fibroblast Growth Factor).

Animal studies have shown that astaxanthin upregulated the expression of these two genes, increased the deposition of hyaluronic acid, reduced tissue scarring, and accelerated the healing process^{21,22,23}.

These ground-breaking studies offer a dietary solution to keep a horse healthy, and make it a better performer at the same time.

Please contact us for sources, references or with any questions you may have about astaxanthin and its health benefits for horses.

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