CoQ10 L-Carnitine Magnesium

INGREDIENTS

Coenzyme Q10 is a vitamin-like nutrient that is vital for cellular energy production. CoQ10 is used in the electron transport chain of mitochondria, the power generators of cells. This activity leads to the production of ATP, the major form of cellular energy which is necessary for many functions including muscular activity. CoQ10 also plays a role in health as a versatile antioxidant, stabilizing cell membranes (helping to protect them from free radical damage) and contributing to their fluidity.[1]

Magnesium is an essential dietary mineral that is involved in many vital functions. Magnesium helps the body regulate proper fluid balance as an electrolyte. It also plays a vital role in the production of ATP, as well production of energy through glycolysis.[2] One third of the body's magnesium content is located in skeletal muscle, there it can quickly be utilized to aid in muscle contractions.[3,4]

L-Carnitine is an amino acid that may be synthesized in the body, using the amino acids lysine and methionine as precursors. L-Carnitine helps shuttle fatty acids into the mitochondria of cells to produce energy. L-Carnitine is largely stored (98% of the body's total content) in skeletal muscle to quickly aid in the production of energy. Carnitine is found in the mitochondria, as it plays a rate-limiting role in Beta oxidation.[5] Fumarate in this form of L-Carnitine also serves as an intermediate in the Krebs cycle, a key cellular energy-producing process.[6]

Together CoQ10 and L-Carnitine are key nutrients necessary to produce cellular energy maintaining an adequate nutritional support level for the cardiovascular system.[1,7,8] Coq10 and L-Carnitine play roles in mitochondrial function but together they have a synergistic function in both mitochondrial energy production and antioxidant protection from peroxidation of oxygen reactive species created during the energy production.[9,10]

BENEFITS

- Helps support cellular energy in heart and muscles*
- Helps support energy production and ATP at cellular level*
- Helps support CoQ10 and L-Carnitine losses due to aging*
- Helps support muscle mass and recovery*

EXTENDED BENEFITS

CoQ10 Helps Support Energy

CoQ10 can preserve energy turnover in our mitochondria by keeping ATP synthesis at optimal levels.[11] Skeletal and heart muscles use up large amounts of ATP during activity. The energy required for a muscle contraction is released when one of ATP's phosphate bonds is broken, in a reaction that produces ADP. Phosphate is added back to ADP, re-forming ATP. CoQ10 supplementation acts to aid in this process by preserving energy turnover in mitochondria, keeping ATP synthesis at optimal levels.[12] Maintenance of normal energy utilization and supply is crucial for maintaining the cell's ideal biochemical state. CoQ10 deficiency may impair mitochondrial energy production and increase production of reactive oxygen species because of its key roles as an electron carrier in mitochondrial bioenergetics and as a lipophilic antioxidant.[13,14,15] Studies have suggested CoQ10 supplementation may aid energy turnover (considered an influencing factor of physical performance). [16,17,18]

CoQ10 Helps Reduce Muscular Fatigue*

CoQ10 has also demonstrated an ability to increase PGC-1α levels. An increase PGC-1α activity has been shown to reduce muscular fatigue and increase mitochondrial energy output by stimulating mitochondrial biogenesis and may even influence muscle fiber composition (towards oxidative mitochondrial-dense type I muscle fiber).[19,20] PGC-1α levels decrease with age, this is believed to result in a loss of muscular efficiency. This suggests CoQ10 supplementation may combat this degradation of muscular function.[21]

Supplement Facts

Serving Size 3 Veggie Capsules
Servings Per Container 30

	Amount Per Serving	% Daily Value
Magnesium (from 1,112 mg magnesium bisglycinate chelate buffered)	200 mg	50%
L-Carnitine Fumarate (yielding 500 mg L-Carnitine)	855 mg	†
Coenzyme Q10 (Ubiquinone)	200 mg	†

† Daily Values not established.

Other Ingredients: Modified cellulose (vegetarian capsule), microcrystalline cellulose, silicon dioxide, magnesium stearate (vegetable source).

Suggested Adult Use: Take 3 capsules daily with food, or as recommended by a nutritionally-informed physician.

USP Verified, Naturally Fermented CoQ10

Non-GMO / Gluten Free / Soy Free / Vegan

Store in a cool dry place.

* These statements have not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure or prevent any disease.

Magnesium Helps Provide Energy and Prevent Loss of Muscle Mass*

Magnesium is required for all reactions involving ATP. ATP also powers the cellular calcium pump, which allows muscle cells to relax. Because it participates in these ATP-controlled processes, magnesium is vitally important for muscle contraction and relaxation. By controlling the flow of sodium, potassium and calcium in and out of cells, magnesium regulates the function of nerves, as well as muscles.[22]

Magnesium could play a role in prevention of age-related loss of skeletal muscle mass, power, and strength directly through physiological mechanisms or indirectly through an impact on chronic low-grade inflammation. A cross-sectional study of 2570 women age 18-79 years examined associations between Mg intake and muscle mass, leg explosive power (LEP), and grip strength. Significant, positive associations were found between higher Mg and indices of skeletal muscle mass and LEP. The results suggest that dietary magnesium may aid conservation of age-related loss of skeletal muscle mass and power in women of all ages.[23]

L-Carnitine Helps Promote Energy and Helps Increase Mitochondrial Biogenesis*

L-Carnitine promotes energy production in cells by transporting fatty acids into the mitochondrion. Its primary function is to transfer long-chain fatty acids across the inner mitochondrial membrane so they can be oxidized to produce energy in the form of ATP.[24] Fatty acid molecules are activated to coenzyme A (CoA) esters in the cytoplasm of the cell, and then esterified to L-Carnitine.[25] L-Carnitine plays a crucial role in energy production in the myocardium as it transports free fatty acids into mitochondria for ATP production in the heart muscle.[26] L-Carnitine is also involved in the removal of toxic compounds generated out of the mitochondria to prevent their accumulation. Given these key functions, L-Carnitine is found highly concentrated in skeletal and cardiac muscles that utilize fatty acids as a dietary fuel for energy.[27]

L-Carnitine has demonstrated an ability to increase mitochondrial biogenesis, as well as mitochondrial size and density. L-Carnitine may also lessen the rate of demise for mitochondria after exercise. The net effect is a significant increase in mitochondrial activity.[28,29]

CLINICAL STUDIES

A study was performed on fifteen healthy men to measure CoQ10's effect on exhaustive, intense bouts of exercise. This study was a randomized, double-blind, crossover study was composed of two 8-week periods of supplementation with either 100 mg CoQ10 or placebo. The participants performed five Wingate tests (exhaustive test of anaerobic power and capacity) with small rest periods between. The rounds of tests were performed three times before and after supplementation. Only those that supplemented with Coq10 saw a significant increase in their mean power output. The authors noted CoQ10's apparent performance enhancing effects and possible use as an ergogenic aid.[30]

A separate double-blind, randomized, crossover study conducted on thirty participants with mitochondrial cytopathy were given CoQ10 daily and put on an exercise regimen for 60 days. Participants that supplemented with CoQ10 saw an increase in VO2 max as well as a decrease in exercise-induced metabolic waste, suggesting an increase in exercise work capacity.[31] Improvements in VO2 max were also noted following CoQ10 supplementation during a study that was conducted to examine CoQ10's effect on endothelial function in patients with ischemic heart disease.[32]

CoQ10's effect on physical fatigue and exercise performance was examined in a double blind, placebo-controlled, triple crossover designed study. This study placed 17 participants on either a CoQ10 or placebo supplementation regimen. The participants were fatigued by performing a fixed workload on a bike during a 2 hour trial. The participants were supposed to bike at maximal velocity (short maximal sprints) for a small amount of time twice during this trial. Those that were supplementing with CoQ10 saw a greater change in speed during the sprints than those given the placebo, as well as being significantly less fatigued at the end of the trial.[33]

Magnesium was also found to improve physical performance in a, randomized, controlled trial of 124 healthy women attending a mild fitness program and randomly selected for either magnesium supplementation or placed in a control group. After baseline assessment and at 12 weeks, the primary outcome was a change in Short Physical Performance Battery (SPPB). The researchers concluded that daily magnesium oxide supplementation for 12 weeks seems to improve physical performance in healthy, elderly women. These findings suggest a role for Magnesium supplementation in preventing or delaying age-related decline in physical performance.[34]

Another study tested whether magnesium influences physical performance of volleyball players. Twenty-five professional male volleyball players were assigned randomly to either magnesium or placebo supplementation for 4 weeks. Significant decreases in lactate production (considered a strong indicator of fatigue) and significantly improved performance in agility tests were noted following magnesium supplementation, but not in control group. The study concluded that magnesium supplementation improved alactic anaerobic metabolism, despite the players having a normal magnesium levels prior to supplementation.[35]

In a double-blind randomized study, 23 competitive triathletes competing in an event consisting of a 500-meter swim, a 20-km bicycle race, and a 5-km run were studied after 4-week supplementation with either magnesium or placebo. The athletes were given blood tests before, during, and after the event to test for energy stress and membrane metabolism. Athletes supplementing with magnesium saw increased blood glucose ("exercise fuel") availability, a decrease in blood proton levels (a sign of lactic acid production [indicator of fatigue]), and improved blood oxygenation compared to placebo. These athletes also saw a greater improvement in the swimming, biking, and running trials compared to the placebo group.[36] A double-blind, placebo-controlled, counterbalanced, and crossover study was conducted to examine L-Carnitine's effect on exercise performance and blood redox status (the measure of the relationship between antioxidant and reactive species levels) in patients with renal disease (a population which is more likely to have relatively poor exercise performance and blood redox status). The participants performed exercise tests before and after 2 months of supplementation. The group that supplemented with L-Carnitine saw improvements in time to exhaustion, post-exercise lactate production, submaximal heart rate and respiratory quotient (indicators of physical fitness), as well as improved significantly improved antioxidant status compared to the placebo group.[37]

A 24-week study was performed to examine L-Carnitine supplementation's effect on performance and fat burning during exercise. Fourteen healthy male participants consumed a small meal of carbohydrates supplemented with or without L-Carnitine twice daily in a double blind, placebo-controlled manner throughout the study. The subjects performed an exercise trial before supplementation, at 12 weeks, and at 24 weeks of the study. Muscle biopsies of the participants were obtained before and twice during each exercise trial. The group receiving L-Carnitine supplementation had higher muscular carnitine levels, demonstrated a greater percentage of fat burning during moderate exercise intensity, and had a better energy production and performance relative to control.[38]

Another crossover, placebo-controlled study was used to examine L-Carnitine's effect on exercise stress in athletic men. 10 participants engaged in a 3-week weightlifting protocol while supplementing with either L-Carnitine or placebo. The athletes were given blood tests and muscle damage was assessed through MRI following exercise. Athletes supplementing with L-Carnitine had lower levels of muscle damage which returned to baseline quicker than the placebo group. The L-Carnitine group also had less apparent muscle damage following MRI examination.[39]

A study was performed looking at L-Carnitine's effect on endurance in athletes. Five athletes were given either water (control), caffeine (CAF),

L-Carnitine (CAR), or L-Carnitine with caffeine (CAR+CAF) in a randomized, double blind fashion while performing an endurance test. The CAR and CAR+CAF had the endurance performances compared to the control and CAF groups. The blood tests suggested that carnitine ingestion could promote fat oxidation, resulting in higher endurance performance in athletes.[40]

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