THE INSTITUTE FOR FUNCTIONAL MEDICINE®

Nutrients for Mitochondrial Health

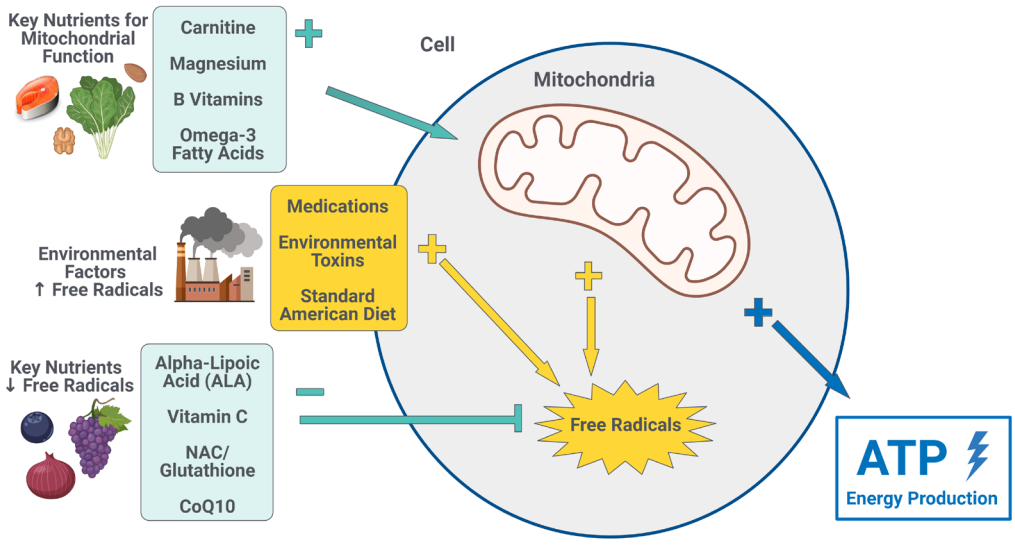
Mitochondria are the parts of cells responsible for creating energy. They are like tiny power plants in every cell of the body, converting food and oxygen into cellular energy in the form of adenosine triphosphate ("ATP").

NUTRIENTS FOR MITOCHONDRIAL HEALTH

- Carnitine
- Magnesium
- B Vitamins
- Omega-3 fatty acids
- Alpha-lipoic acid
- Vitamin C
- N-acetyl Cysteine/Glutathione
- Coenzyme Q10

Molecules called "free radicals" are produced as a byproduct of this energy production. An analogy for this would be the exhaust that comes from an engine. Free radicals need to be neutralized or they will create damage (often referred to as "oxidative stress") in the body. Excess free radicals can damage the body by initiating the death of cells, leading to premature aging. The goal then is for the mitochondrial "engine" to burn cleaner and produce fewer free radicals.

Poor mitochondrial function has been identified as a factor in the development of heart disease, diabetes, memory decline, and other neurological conditions. Some of the nutrients below, along with other dietary and lifestyle changes, can improve mitochondrial health by supplying key nutrients for improved mitochondrial energy production. Other nutrients decrease the damaging effects of free radicals produced in the mitochondria. For personalized recommendations on foods and supplements for mitochondrial health, please talk to your functional medicine provider.



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Version 3; updated 2024

Carnitine is a nutrient that transports fats into the mitochondria to be used for energy production. Low levels of carnitine can contribute to decreased energy production and mitochondrial dysfunction. Some studies have indicated that supplementing with carnitine may improve fatigue and brain function.

Magnesium is a mineral that is necessary for optimal mitochondrial function. Restoring the body's magnesium can have a protective role in heart health, blood pressure, and is associated with improvements in depressive symptoms.

B vitamins are directly involved in the process of energy production, by enhancing activity within the mitochondria and offsetting the damaging effects of oxidative stress. Supplementation with B vitamins has been shown to improve mental performance in those with mild cognitive impairment. Studies also show that vitamin B12 and folate (vitamin B7) protect mitochondrial function and may improve depressive symptoms, particularly in those with MTHFR genetic variants.

Omega-3 fatty acids (EPA & DHA) are used by mitochondria to produce energy. Both EPA and DHA reduce inflammation, which indirectly protects the health of mitochondria. Supplementing with omega-3 fatty acids has been shown to have a positive effect on muscle mass and walking speed, particularly in people aged 60 years or older. Studies also indicate that supplementing with omega-3 fatty acids can enhance cognitive function.

Alpha-lipoic acid (ALA) is an essential nutrient for mitochondrial energy production. ALA also acts as a powerful antioxidant to reduce oxidative stress during cellular energy production. Studies indicate that ALA can improve diabetic neuropathy and insulin sensitivity.

Vitamin C is a vitamin and antioxidant which protects the mitochondria from oxidative stress. Studies have found an association between the body's vitamin C level and cognitive performance. Vitamin C may be depleted in people with cognitive impairment, such as Alzheimer's disease. Some studies have indicated that restoring the body's vitamin C may help improve feelings of anxiety, fatigue, and well-being.

N-acetyl cysteine (NAC) is an antioxidant that indirectly protects mitochondria from oxidative stress. Supplementing with NAC helps to restore the body's level of glutathione. Glutathione is a powerful antioxidant produced inside the body, and it can be depleted in many chronic diseases due to oxidative stress.

Coenzyme Q10 (CoQ10) is a key component in cellular energy production. It has anti-inflammatory and antioxidant properties, helping mitochondria remain efficient and healthy. Aging, genetics, and statin medications can contribute to a lower level of CoQ10 in the body. Supplementing with CoQ10 has been shown to improve fatigue and depression in patients with multiple sclerosis, as well as improve symptoms of diabetic neuropathy and Parkinson's disease.

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