REPORT

Reverse Mitochondrial Damage

Potent Molecular Energizers for Lifelong Health

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A COMPLEMENTARY COENZYME

Lipoic acid is a naturally occurring compound found in mitochondria. Like CoQ10, it is a ***coenzyme*** required for proper function of the mitochondrial energy chain.[4] Lipoic acid directly increases ATP production in mitochondria.[79] Clinical models indicate that lipoic acid may serve as a first-line defense for diseases involving impaired energy utilization, including diabetes and the nerve damage associated with it.[80-82]

R-alpha-lipoic acid is the most bioactive form of lipoic acid—and a powerful activator of mitochondrial energy complexes.[83,84] Studies in aging animals support the use of R-alpha-lipoic acid to improve mitochondrial function, decrease oxidative damage, and increase metabolic rate, all of which otherwise become impaired with aging.[4]

R-alpha-lipoic acid has been proven effective in reducing symptoms of diabetic neuropathy, without significant adverse reactions.[81,85] It also increases nerve conduction velocity in people with diabetic neuropathy, crucial to improved nerve signaling.[86] Experts attribute these effects to diminished fat oxidation in nerve cell membranes and improvements in local blood supply around nerves resulting from improved mitochondrial functioning.[87,88]

R-alpha-lipoic acid displays many protective effects. It reverses the age-related increase in liver cell damage caused by exogenous toxins, helping to protect liver function.[89] It prevents brain cells from becoming depleted of the natural antioxidant *reduced glutathione,* an important intracellular antioxidant in the body. Deficiency of reduced glutathione can predispose people to liver failure, Parkinson's disease, and other neurodegenerative conditions.[90,91] A therapeutic dose of **600 mg/day** even helped relieve migraine attack rates—an observation that may support the theory that migraines may be partially caused by impaired mitochondrial function.[92]

As you might expect of a mitochondrial energy booster, lipoic acid may also play a role in helping to ward off cardiovascular disease. Three months of lipoic acid supplementation provided pain relief to patients with peripheral vascular disease (PVD), extending the time they could walk before pain occurred.93 Combined therapy with acetyl-L-carnitine improved blood vessel relaxation and blood flow, while reducing blood pressure, in patients with coronary artery disease.94 And combined supplementation is a very good idea, as we'll see next.

YOUR MITOCHONDRIAL FAT-BURNER

L-carnitine is a molecule required for helping transport fatty acids into the mitochondria, where they can be burned as fuel. Acetyl-L-carnitine (ALC) is the *form* of carnitine optimally absorbed through oral delivery. It has also been shown to boost mitochondrial health, facilitating fuel delivery to the electron transport chain, where supplements like CoQ10, shilajit, and lipoic acid take over.

Total carnitine levels diminish with age, a decline that may also be accelerated by overeating and diabetes.[95] As with other mitochondrial energy optimizers, ALC supplementation possesses distinct benefits across numerous physiological systems.[96]

A review of clinical studies shows that ALC may slow the natural course of Alzheimer's disease.[97] It has substantially increased Alzheimer's disease patients' responses to drug treatment, from **38%** to **50%** in one study.[98] ALC also protects brain tissue against destructive effects of hypoxia (low oxygen), by supporting cellular metabolism.[99] ALC and lipoic acid supplementation partially restored depleted brain mitochondrial activity in aged rats to that of young adults.[100]

The combination of ALC with lipoic acid improved cognitive function in a mouse model of Alzheimer's disease.[101] ALC alone has exhibited powerful effects, restoring aging animals' cardiac energy metabolism to that of young adults.[102] In combination with lipoic acid, ALC helps maintain heart muscle function in aging animals as well.[103]

SUMMARY

Mitochondrial dysfunction is linked to a broad range of degenerative illness, from diabetes and neurological disorders to heart disease. Researchers have discovered that age-related mitochondrial dysfunction—which can ultimately lead to DNA damage and cell death—may be prevented and even *reversed.* The key lies in early and sustained interventions that support optimal mitochondrial health and function. CoQ10 in its superior form as **ubiquinol** may restore mitochondrial function. The organic adaptogen ***shilajit*** acts in synergy with ubiquinol, further enhancing mitochondrial function. R-alpha-lipoic acid and acetyl-L-carnitine have been shown in clinical studies to provide additional mitochondrial support.

If you have any questions on the scientific content of this article, please call a Life Extension® Health Advisor at 1-866-864-3027.

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