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The Many Benefits of CoQ10 and Ubiquinol

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STORY AT-A-GLANCE

- CoQ10 is a powerful, fat-soluble antioxidant that also has anti-inflammatory effects and plays a role in energy production
- It's found throughout your body in cell membranes, but it's most abundant in your heart, lungs, liver, kidneys, spleen, pancreas and adrenal glands
- CoQ10 offers significant benefits for heart health, kidney function, liver disease, migraines and more
- Your production of CoQ10 peaks around the age of 25, then begins to decline; by the age of 65, your body typically produces only about half the amount it did at 25
- Many people, including older adults, those with certain chronic diseases and people taking statin drugs, benefit from ubiquinol supplementation; ubiquinol is the reduced version of CoQ10 that's more easily absorbed

Coenzyme Q10 or simply CoQ10, (ubiquinone) is a fat-soluble molecule that is found in all cells of your body. It plays a crucial role in the electron transport chain, which is a series of reactions that occur in the mitochondria to generate energy in the form of ATP.[1]

In addition to its role in energy production, CoQ10 also has antioxidant properties. It can neutralize harmful free radicals and protect cells from oxidative damage. This is particularly important in mitochondria, as the electron transport chain can sometimes leak electrons, leading to the formation of free radicals. CoQ10 helps prevent this leakage and reduces the risk of oxidative stress.

It is worth noting that the quality and composition of CoQ10 supplements can vary. Some commercially available CoQ10 products may be dissolved in vegetable oil, which can affect the interaction between it and other molecules. This may have implications for its respiratory function and potential toxicity for mitochondria.

"CoQ10 is essential for the health of virtually all human tissues and organs," a review in the Journal of Pharmacy & BioAllied Sciences notes.[2] While it's found throughout the body in cell membranes, it's most abundant in your heart, lungs, liver, kidneys, spleen, pancreas and adrenal glands.[3]

As the third most consumed dietary supplement,[4] CoQ10's reputation for health and wellness has gotten around, but its clinical relevance is still very much underappreciated. And the same holds true for ubiquinol — the reduced, electron-rich form of CoQ10 that your body produces naturally.

How CoQ10 Benefits Your Health

CoQ10 protects cellular membranes from oxidative stress induced by free radicals. It also has anti-inflammatory properties. Supplementing with 60 milligrams (mg) to 500 mg of CoQ10 for eight to 12 weeks can significantly reduce tumor necrosis factor alpha (TNF-α), IL-6 and C-reactive protein (CRP);[5,6] three measures of widespread inflammation, impacting a number of chronic diseases. CoQ10 also plays a role in a number of other important functions, including:[7]

Cholesterol metabolism	Regeneration of vitamins C and E
Maintaining lysosomal pH	Sulfur metabolism
Amino acid metabolism	Gene expression

Heart health, however, is CoQ10's claim to fame. Many conditions, including heart disease, appear to be rooted in mitochondrial dysfunction.[8] Cardiac muscle cells have about 5,000 mitochondria per cell,[9] where CoQ10 concentrates. For further comparison,

mitochondria make up about 35% of the volume of cardiac tissue and only 3% to 8% of the volume of skeletal muscle tissue.[10]

Further, scavenging of reactive oxygen species (ROS) and a reduction in oxidative stress are an essential part of keeping the heart functioning normally,[11] including helping to ward off atrial fibrillation.[12]

Atrial fibrillation is an abnormal, often rapid, heart rhythm that occurs when the atria, your heart's upper chambers, beat out of sync with the ventricles, the heart's lower chambers. It's a common symptom in those with heart failure or heart disease.

In one study, 102 patients with atrial fibrillation were divided into two groups. One group was given a CoQ10 supplement while the other group was given a placebo. After 12 months of supplementation, 12 people in the placebo group had atrial fibrillation episodes compared to only three people in the CoQ10 group.[13] Levels of malondialdehyde, a known biomarker of oxidative stress, also went down significantly in the CoQ10 group.

A systematic review and meta-analysis of cardiovascular risk factors spanning 884 randomized controlled trials with 883,627 participants also found CoQ10 decreased all-cause mortality events.[14] Meanwhile, CoQ10 influences several other aspects of heart health, including:

- **High blood pressure —** CoQ10 acts directly on your endothelium, dilating your blood vessels and lowering blood pressure.[15,16] CoQ10 also decreases aldosterone, a hormone that makes you retain salt and water.[17,18] When aldosterone goes down, excess salt and water are excreted through your kidneys, often causing your blood pressure to go down.
- **Stroke —** Systemic inflammation, oxidative stress and nerve cell damage play a role in the development of stroke. Research suggests supplementing with CoQ10 can reduce ischemic lesions and improve outcomes in patients who have been treated with a statin drug after having a stroke (statins reduce CoQ10 levels in your body).[19]

CoQ10 Benefits Migraines, Kidney Function, NAFLD and More

If you suffer from **migraine headaches**, you may be interested to know that CoQ10 may play a preventative role in the condition. A meta-analysis of five studies found CoQ10 was more effective than placebo in reducing the number of migraine days per month, along with migraine duration.[20]

CoQ10 is also protective of the kidneys and may be useful in cases of acute kidney injury due to drugs like nonsteroidal anti-inflammatories, sepsis and other causes. The protective benefits are likely due to CoQ10's "anti-inflammatory effects, gene expression regulation, enhancement of the activity of antioxidant enzymes, free-radical scavenging, and lipid bilayer membrane stabilization."[21]

Its ability to reduce oxidative stress makes CoQ10 useful for age-related diseases as well, with some studies suggesting it can increase lifespan in animal models.[22] Benefits have also been found for improving fertility in older women and reducing fertility decline in men.[23] It may also stop the progression of nonalcoholic fatty liver disease (NAFLD).

In one study, 44 patients were divided into two groups. One group was given 100 mg of CoQ10 each day, while the other was given a placebo. After four weeks of supplementation, the group taking CoQ10 dropped weight and had lower levels of serum AST, a blood marker that indicates liver disease and/or damage.[24]

CoQ10 Levels Decrease With Age

Your body can naturally make CoQ10, but genetic alterations in metabolism, poor diet, oxidative stress, chronic conditions and aging can all interfere with CoQ10 production and lead to CoQ10 deficiency.

While the optimal daily requirement for CoQ10 isn't known, it's been estimated at 500 mg per day. Since only an estimated 5 mg comes from dietary sources, most of this is dependent on being synthesized within your body. Your production of CoQ10 peaks

around the age of 25, however, then begins to decline. By the age of 65, your body typically produces only about half the amount it did at 25.[25]

A CoQ10 deficiency can result, which causes a number of deleterious effects, not the least of which is impaired antioxidant defense against oxidative stress caused by free radicals. According to researchers with Liverpool John Moores University in the U.K.:[26]

> *"Primary CoQ10 deficiency can affect any part of the body, but particularly the brain, muscle and kidney tissues, as a consequence of their high energy demands. The severity and time frame of symptoms are variable; severe symptoms may be evident in infancy, whereas mild symptoms may not become apparent until the individual is in their 60s."*

In the brain, CoQ10 deficiency can lead to impaired balance and coordination known as ataxia, along with other neurological symptoms. In the kidneys, lack of CoQ10 may cause dysfunction, while in the heart, a weakened heart muscle, similar to hypertrophic cardiomyopathy, can occur.[27] Further, the U.K. team explained:[28]

> *"Secondary deficiencies of CoQ10 typically occur in the mitochondrial myopathies, cardiovascular disease, type II diabetes, chronic kidney disease, liver disease and critical illness. Depletion of CoQ10 in these disorders may compromise cellular antioxidant status and result in impaired mitochondrial function and cellular energy supply, resulting in, for example, heart failure."*

If you take statin cholesterol-lowering drugs, be aware that they block HMG coenzyme A reductase in your liver, which is how they reduce cholesterol. But this is also the same enzyme that makes CoQ10, making its depletion likely.

Statin-induced CoQ10 deficiency may be responsible for the myopathic — or relating to muscle control — side effects often attributed to these drugs. Interestingly, LDL cholesterol is the major carrier of CoQ10 in your circulation, so it's also been suggested that the decrease in CoQ10 among statin users is related to the decrease in LDL.[29]

The Difference Between CoQ10 and Ubiquinol

Ubiquinol is the reduced version of CoQ10, also known as ubiquinone. They're the same molecule, but when CoQ10 is reduced it takes on two electrons, which turns it into ubiquinol. In your body, this conversion occurs thousands of times every second inside your mitochondria.

The flipping back and forth between these two molecular forms is part of the redox (oxidation/reduction) process that transforms food into energy. Young people are able to use CoQ10 supplements quite well, but older people do better with ubiquinol, as it's more readily absorbed. You can get some CoQ10 from food as well. Food sources include wild-caught salmon, mackerel, sardines, eggs and organ meats.[30]

You may also be able to improve your body's conversion of CoQ10 to ubiquinol by eating lots of green leafy vegetables, which are loaded with chlorophyll, in combination with sun exposure.[31,32]

CoQ10 and Ubiquinol Dosing

Before we get to the dosing, if you plan on supplementing with CoQ10 you must be absolutely certain the supplement does not contain any vegetable oil in it, as the unsaturated fat will damage the CoQ10 and it will not work optimally.

Most of your CoQ10 requirements are met by making your own. But if your body's production has declined with age or due to other reasons, like statin drugs, supplementation may be beneficial. Dosing requirements vary depending on your individual situation and needs.

If you're just starting out with ubiquinol, start with 200 mg to 300 mg per day. Within three weeks, your plasma level will typically plateau to its optimum level. After that, you can go down to a 100 mg per day maintenance dose. This dose is typically sufficient for healthy people. If you have an active lifestyle, exercise a lot or are under a lot of stress, you may want to increase your dose to 200 to 300 mg per day.

If you're taking a statin drug you must also take at least 100 to 200 mg of ubiquinol or CoQ10 per day, or more. Supplementation is also appropriate for those with chronic

diseases such as heart disease, diabetes, amyotrophic lateral sclerosis (ALS), chronic fatigue and autism. Ideally, split the dose up so you're taking it two or three times a day, rather than taking it all at once, as this will result in higher blood levels.

To find out the best dose for your needs, you'll want to work with your integrative physician. Remember, too, that CoQ10 is a fat-soluble antioxidant, so consume it along with a healthy source of fat for optimal absorption.

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