

# Coenzyme Q<sub>10</sub>

**Coenzyme Q<sub>10</sub>**, also known as **ubiquinone**, **ubidecarenone**, **coenzyme Q**, and abbreviated at times to **CoQ<sub>10</sub>** /ˌkoʊ ˈkjuː ˈtɛn/, **CoQ**, **Q10**, or **Q**, is a 1,4-benzoquinone, where **Q** refers to the quinone chemical group, and **10** refers to the number of isoprenyl chemical subunits in its tail.

This oil-soluble, vitamin-like substance is present in most eukaryotic cells, primarily in the mitochondria. It is a component of the electron transport chain and participates in aerobic cellular respiration, generating energy in the form of ATP. Ninety-five percent of the human body's energy is generated this way. Therefore, those organs with the highest energy requirements—such as the heart, liver and kidney—have the highest CoQ<sub>10</sub> concentrations.

There are three redox states of Coenzyme Q10: fully oxidized (ubiquinone), semiquinone (ubisemiquinone), and fully reduced (ubiquinol). The capacity of this molecule to exist in a completely oxidised form and a completely reduced form enables it to perform its functions in electron transport chain and as an antioxidant respectively.

## Supplementation benefits

Coenzyme Q10 is the 3rd most sold dietary ingredient in the United States after Omega-3 and multivitamins.

According to the Mayo Clinic, "CoQ10 has been used, recommended, or studied for numerous conditions, but remains controversial as a treatment in many areas." Further clinical results are needed to determine whether supplementation with coenzyme Q<sub>10</sub> is beneficial for healthy people.

### Heart health

Coenzyme Q10 helps to maintain a healthy cardiovascular system. There is evidence of CoQ10 deficiency in heart failure. Recently, CoQ10 plasma concentrations have been demonstrated as an independent predictor of mortality in chronic heart failure, CoQ10 deficiency being detrimental to the long-term prognosis of chronic heart failure. CoQ10 is available as medicine in several European countries, but is in these countries also available as a food supplement. Oxidation of the circulating LDL is thought to play a key role in the pathogenesis of atherosclerosis, which is the underlying disorder leading to heart attack and ischemic strokes and CHD. Studies in the last decade have demonstrated that the content of Ubiquinol in human LDL affords protection against the oxidative modifications of LDL themselves, thus lowering their atherogenic potency.

### Migraine headaches

Supplementation of coenzyme Q<sub>10</sub> has been found to have a beneficial effect on the condition of some sufferers of migraine headaches. So far, three studies have been done, of which two were small, did not have a placebo group, were not randomized, and were open-label, and one was a double-blind, randomized, placebo-controlled trial, which found statistically significant results despite its small sample size of 42 patients. Dosages were 150 to 300 mg/day.

It has been used effectively in the prophylaxis of migraines, especially in combination with a daily supplement of magnesium citrate 500 mg and riboflavin (vitamin B2) 400 mg.

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## Cancer

CoQ<sub>10</sub> is also being investigated as a treatment for cancer, and as relief from cancer treatment side-effects.

## Cardiac arrest

Another recent study shows a survival benefit after cardiac arrest if coenzyme Q<sub>10</sub> is administered in addition to commencing active cooling of the body to 90–93 degrees Fahrenheit (32–34 degrees Celsius).

## Blood pressure

There are several reports concerning the effect of CoQ<sub>10</sub> on blood pressure in human studies. A recent (2007) meta-analysis of the clinical trials of CoQ<sub>10</sub> for hypertension reviewed all published trials of coenzyme Q<sub>10</sub> for hypertension, and assessed overall efficacy, consistency of therapeutic action, and side-effect incidence. Meta-analysis was performed in 12 clinical trials (362 patients) comprising three randomized controlled trials, one crossover study, and eight open-label studies. The meta-analysis concluded that coenzyme Q<sub>10</sub> has the potential in hypertensive patients to lower systolic blood pressure by up to 17 mm Hg and diastolic blood pressure by up to 10 mm Hg without significant side-effects.

## Periodontal disease

Studies have shown that diseased gum tissue is deficient in CoQ<sub>10</sub> compared to healthy gum tissue. Human clinical trials have suggested a link between oral administration of CoQ<sub>10</sub> and improved gingival health, immune response in gum tissues, and a reversal of the diseased gum conditions. In addition to oral supplementation, topical application of CoQ<sub>10</sub> on gum tissues has been shown to improve periodontitis and gingivitis conditions.

## Lifespan

One study demonstrated that low dosages of coenzyme Q<sub>10</sub> reduce oxidation and DNA double-strand breaks, and a combination of a diet rich in polyunsaturated fatty acids and coenzyme Q<sub>10</sub> supplementation leads to a longer lifespan in rats. Coles and Harris demonstrated an extension in the lifespan of rats when they were given coenzyme Q<sub>10</sub> supplementation. But multiple studies have since found no increase in lifespan or decrease in aging in mice and rats supplemented with coenzyme Q<sub>10</sub>. Another study demonstrated that coenzyme Q<sub>10</sub> extends the lifespan of *C. elegans* (nematode).

## Radiation injury

A 2002 study reported that, in rat experiments, coenzyme Q<sub>10</sub> taken as dietary supplement reduced radiation damage to the animals' blood.

## Parkinson's disease

A 2002 study in 80 Parkinson's disease patients found 1200 mg/day reduced the progression by 44%. and a phase III trial of 1200 mg/d and 2400 mg/d should run until 2011.