

Coenzyme Q10 - The Wonder Nutrient

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What does congestive heart failure, gum disease and obesity have in common? Very often, a deficiency of coenzyme Q10 (CoQ10). A lack of CoQ10 has also been implicated in arrhythmias, strokes, hypertension, heart attacks, atherosclerosis, muscular dystrophy and AIDS and many of these diseases can be prevented and treated successfully with CoQ10. Since its discovery and isolation 40 years ago hundreds of clinical research studies have been done on CoQ10 and it is now abundantly clear that this nutrient is absolutely vital to health(1-5).

Coenzyme Q10 (ubiquinone/ubiquinol) is a fat-soluble quinone with a structure similar to that of vitamin K. It is a powerful antioxidant both on its own and in combination with vitamin E and is vital in powering the body's energy production (ATP) cycle. CoQ10 is found throughout the body in cell membranes, especially in the mitochondrial membranes and is particularly abundant in the heart, lungs, liver, kidneys, spleen, pancreas and adrenal glands. The total body content of CoQ10 is only about 500-1500 mg and decreases with age(5).

Essential to the heart

Coenzyme Q10 has received particular attention in the prevention and treatment of various forms of cardiovascular disease. It is highly effective in preventing the oxidation of low-density lipoprotein cholesterol (LDL) that leads to atherosclerosis(2,6-8). Several studies have shown that patients with congestive heart failure and other cardiovascular diseases have significantly lower levels of CoQ10 in their heart tissue than do healthy people and supplementation with as little as 100 mg/day has been shown to markedly improve their condition. CoQ10 is now approved in Japan for the treatment of congestive heart failure(2-5,9,10).

Heart attacks and strokes produce a burst of free radicals (ischemia-reperfusion) that can result in extensive tissue damage. Patients with high CoQ10 levels suffer less damage from these events and Japanese researchers have found that CoQ10 supplementation prior to and immediately following open-heart surgery is highly beneficial in preventing reperfusion injury - a common complication in heart surgery(2,4,5,11,12). Supplementation with CoQ10 has also been found beneficial in patients with chronic stable angina, mitral valve prolapse and irregular heart beat (arrhythmias)(2-5,13-15).

Coenzyme Q10 has also proven useful in the treatment of various cardiomyopathies (diseases of the heart muscle that reduces its pumping capacity). Studies have shown that supplementation with as little as 100 mg/day for 12 months results in better pumping capacity (increased ejection fraction), increased muscle strength and improved breathing(2-4,16).

Several studies indicate that CoQ10 may be beneficial in the treatment of hypertension (high blood pressure). A study of 109 patients with long-standing, essential hypertension, who were on antihypertensive drugs, concluded that supplementation with an average of 225 mg/day of CoQ10 improved functional status, allowed about half the patients to discontinue most of their blood pressure medications and resulted in an average decrease of systolic blood pressure from 159 to 147 mm Hg and a diastolic pressure decrease from 94 to 85 mm Hg. Smaller, more recent Japanese studies have confirmed these findings (2-5,17-19).

Studies at the University of Ancona in Italy have provided evidence that CoQ10 supplementation reduces blood levels of epinephrine (adrenalin) and other catecholamines; this is believed to be partly responsible for the drop in blood pressure and may also explain why CoQ10 is effective in reducing the incidence of certain types of arrhythmias(2,20).

Boosts energy and brain power

Coenzyme Q10 is a great boost to heart health, but it has many other beneficial effects. Strenuous physical exercise reduces blood levels of CoQ10 and supplementation with 60 mg/day has been found to improve athletic performance(2,3,21). Administration of CoQ10 alone or in combination with vitamin B6 (pyridoxine) boosts the immune system and may be useful in the treatment of AIDS and other infectious diseases(3,22,23). An adequate level of CoQ10 in the body is essential to proper muscle functioning and several studies have indeed shown that supplementation with 100-150 mg/day of CoQ10 markedly improves the condition of people suffering from muscular dystrophy(2-5,25-28).

Many overweight people have very low levels of CoQ10 and supplementation may enable them to lose weight due to the effect of CoQ10 in speeding up the metabolism of fats(3,4,29).

Some very recent, highly intriguing research carried out at the Institute of Neurosciences in Argentina has shown that brain activity and alertness is enhanced in hypertensive patients within one hour of oral administration of 100 mg of CoQ10(30).

Keeps your gums healthy and fights cancer

CoQ10 has been used with success in combating periodontal diseases, especially gingivitis (gum disease). Tissue affected by gingivitis is deficient in CoQ10 and experiments have shown that supplementation with as little as 50 mg/day can decrease inflammation. More recent research has shown that topical application of CoQ10 dissolved in soy oil (85 mg/ml) to affected areas (periodontal pockets) reduces bleeding and the depth of the pockets(2-5,31-34).

Research carried out in Denmark has provided some tantalizing evidence that CoQ10 may also be effective in the fight against certain cancers. A trial involving the treatment of 32 breast cancer patients with mega doses of vitamins, minerals, essential fatty acids and coenzyme Q10 (90 mg/day) in addition to conventional therapy showed a highly beneficial effect of the supplementation. Two of the patients in the trial whose tumours had not regressed had their CoQ10 dosages increased to 390 mg/day and 300 mg/day respectively with the result that their tumours disappeared completely within three months(3,35). CoQ10 supplementation is also very important for cancer patients undergoing chemotherapy with heart toxic drugs such as adriamycin and athralines. Recent research has also shown that certain cholesterol-lowering drugs (lovastatin, etc.) block the natural synthesis of CoQ10 so supplementation with 100 mg/day is recommended for patients taking these drugs(2,3,36).

So how much do you need?

The body can synthesize coenzyme Q10 and it is also found in several dietary sources, notably organ meats. The level of CoQ10 in human organs peaks around the age of 20 years and then declines fairly rapidly. The decrease in CoQ10 concentration in the heart is particularly significant with a 77-year-old person having 57 per cent less CoQ10 in the heart muscle than a 20-year-old(30). Some experts involved in CoQ10 research believe that many people, especially older people and people engaging in vigorous exercise may be deficient in CoQ10 and may benefit from supplementation. The recommended daily dosage for health maintenance is 30 mg; however, considerably higher amounts are required in the treatment of the various diseases for which

supplementation has been found beneficial (2,3,37,38). CoQ10 should be taken with a meal containing some fat or even better, in combination with soy or vegetable oil which enhances its absorption quite substantially (3). The body readily absorbs CoQ10 supplements and no toxic effects have been reported for daily dosages as high as 300 mg. The safety of CoQ10, however, has not been established in pregnancy and lactation, so caution is advised here until more data becomes available (3,5).

REFERENCES

1. Kagan, Valerian E., et al. Coenzyme Q: Its role in scavenging and generation of radicals in membranes. In *Handbook of Antioxidants*, eds. Enrique Cadenas and Lester Packer, NY, Marcel Dekker, Inc., 1996, pp. 157-201
2. Littarru, Gian Paolo, et al. Clinical aspects of coenzyme Q: Improvement of cellular bioenergetics or antioxidant protection? In *Handbook of Antioxidants*, eds. Enrique Cadenas and Lester Packer, NY, Marcel Dekker, Inc., 1996, pp. 203-39
3. Murray, Michael T. *Encyclopedia of Nutritional Supplements*, Rocklin, CA, Prima Publishing, 1996, pp. 296-308
4. Bliznakov, Emile G. and Hunt, Gerald L. *The Miracle Nutrient Coenzyme Q10*. NY, Bantam Books, 1986
5. Greenberg, Steven and Frishman, William H. Co-enzyme Q10: A new drug for cardiovascular disease. *Journal of Clinical Pharmacology*, Vol. 30, 1990, pp. 596-608
6. Frei, Balz, et al. Ubiquinol-10 is an effective lipid-soluble antioxidant at physiological concentrations. *Proceedings of the National Academy of Sciences USA*, Vol. 87, June 1990, pp. 4879-83
7. Stocker, Roland, et al. Ubiquinol-10 protects human low density lipoprotein more efficiently against lipid peroxidation than does alpha-tocopherol. *Proceedings of the National Academy of Sciences USA*, Vol. 88, March 1991, pp. 1646-50
8. Hanaki, Yoshihiro, et al. Ratio of low-density lipoprotein cholesterol to ubiquinone as a coronary risk factor. *New England Journal of Medicine*, Vol. 325, September 12, 1991, pp. 814-15
9. Langsjoen, P.H., et al. Long-term efficacy and safety of coenzyme Q10 therapy for idiopathic dilated cardiomyopathy. *American Journal of Cardiology*, Vol. 65, 1990, pp. 521-23
10. Baggio, E., et al. Italian multicenter study on the safety and efficacy of coenzyme Q10 as adjunctive therapy in heart failure. *Molec. Aspects Med.*, Vol. 15 (suppl), 1994, pp. S287-94
11. Chello, M., et al. Protection of coenzyme Q10 from myocardial reperfusion injury during coronary artery bypass grafting. *Ann. Thorac. Surg.*, Vol. 58, 1994, pp. 1427-32
12. Judy, W.V., et al. Myocardial preservation by therapy with coenzyme Q10 during heart surgery. *Clin. Invest.*, Vol. 71 (suppl), 1993, pp. 155-61
13. Oda, T. Coenzyme Q10 therapy on the cardiac dysfunction in patients with mitral valve prolapse. Dose vs effect and dose vs serum level of coenzyme Q10. In *Biomedical and Clinical Aspects of Coenzyme Q*, Vol. 5, eds. Folkers, K. and Yamamura, Y., Amsterdam, Elsevier, 1986, pp. 269-80
14. Fujioka, T., et al. Clinical study of cardiac arrhythmias using a 24 hour continuous electrocardiographic recorder (5th report). Antiarrhythmic action of coenzyme Q10 in diabetes. *Tohoku J. Exp. Med.*, Vol. 141 (suppl), 1983, p. 453
15. Ohnishi, S., et al. The effect of coenzyme Q10 on premature ventricular contraction. In *Biomedical and Clinical Aspects of Coenzyme Q*, Vol. 5, eds. Folkers, K. and Yamamura, Y., Amsterdam, Elsevier, 1986, pp. 257-66
16. Langsjoen, P.H., et al. Response of patients in classes III and IV of cardiomyopathy to therapy in a blind and crossover trial with coenzyme Q10. *Proceedings of the National Academy of Sciences USA*, Vol. 82, 1985, p. 4240
17. Langsjoen, P., et al. Treatment of essential hypertension with coenzyme Q10. *Molec. Aspects Med.*, Vol. 15 (suppl), 1994, pp. S265-72
18. Digiesi, V., et al. Mechanism of action of coenzyme Q10 in essential hypertension. *Curr. Ther. Res.*, Vol. 51, 1992, pp. 668-72
19. Digiesi, V., et al. Coenzyme Q10 in essential hypertension. *Molec. Aspects Med.*, Vol. 15 (suppl), 1994, pp. S257-63
20. Ursini, F., et al. Coenzyme Q10 treatment of heart failure in the elderly: preliminary results. In *Biomedical and Clinical Aspects of Coenzyme Q*, Vol. 6, eds. Folkers, K., et al., Amsterdam, Elsevier, 1991, pp. 473-80
21. Vanfraechem, J.H.P. and Folkers, K. Coenzyme Q10 and physical performance. In *Biomedical and Clinical Aspects of Coenzyme Q*, Vol. 3, eds. Folkers, K. and Yamamura, Y., Amsterdam, Elsevier, 1981, pp. 235-41
22. Folkers, K., et al. The activities of coenzyme Q10 and vitamin B6 for immune responses. *Biochemical and*

- Biophysical Research Communications, Vol. 193, May 28, 1993, pp. 88-92
23. Folkers, K., et al. Coenzyme Q10 increases T4/T8 ratios of lymphocytes in ordinary subjects and relevance to patients having the AIDS related complex. *Biochemical and Biophysical Research Communications*, Vol. 176, April 30, 1991, pp. 786-91
 24. Sovik, O., et al. Coenzyme Q in Duchenne muscular dystrophy. *Acta Paediat. Scand.*, Vol. 60, 1971, p. 428
 25. Folkers, K., et al. Effect of coenzyme Q on serum levels of creatine phosphokinase in preclinical muscular dystrophy. *Proceedings of the National Academy of Sciences USA*, Vol. 71, No. 5, 1974, p. 2098
 26. Folkers, K., et al. Biochemical rationale and the cardiac response of patients with muscle disease to therapy with coenzyme Q10. *Proceedings of the National Academy of Sciences USA*, Vol. 82, 1985, p. 4513
 27. Folkers, K., et al. Therapy with coenzyme Q10 for muscle dystrophy and neurogenic atrophies by double-blind trial. In *Biomedical and Clinical Aspects of Coenzyme Q*, Vol. 5, eds. Folkers, K. and Yamamura, Y., Amsterdam, Elsevier, 1986, pp. 353-58
 28. Folkers, K. and Simonsen, R. Two successful double-blind trials with coenzyme Q10 (vitamin Q10) on muscular dystrophies and neurogenic atrophies. *Biochem. Biophys. Acta*, Vol. 1271, 1995, pp. 281-86
 29. van Gaal, L., et al. Exploratory study of coenzyme Q10 in obesity. In *Biomedical and Clinical Aspects of Coenzyme Q*, Vol. 4, eds. Folkers, K. and Yamamura, Y., Amsterdam, Elsevier, 1984, pp. 369-73
 30. Marincola, Rodolfo. Neurobiology and quantified pharmaco EEG of coenzyme Q10. *Journal of Orthomolecular Medicine*, Vol. 12, No. 2, Second Quarter, 1997, pp. 87-95
 31. Nakamura, R., et al. Study of CoQ10-enzymes in gingiva from patients with periodontal disease and evidence for a deficiency of coenzyme Q10. *Proceedings of the National Academy of Sciences USA*, Vol. 71, 1974, p. 1456
 32. Littarru, G.P., et al. Deficiency of coenzyme Q10 in gingival tissue from patients with periodontal disease. *Proceedings of the National Academy of Sciences USA*, Vol. 68, 1971, p. 2332
 33. Wilkinson, E.G., et al. Treatment of periodontal and other soft tissue diseases of the oral cavity with coenzyme Q. In *Biomedical and Clinical Aspects of Coenzyme Q*, Vol. 1, eds. Folkers, K. and Yamamura, Y., Amsterdam, Elsevier, 1977, pp. 251-65
 34. Hanioka, T., et al. Effect of topical application of coenzyme Q10 on adult periodontitis. *Molec. Aspects Med.*, Vol. 15 (suppl), 1994, pp. S241-48
 35. Lockwood, K., et al. Partial and complete regression of breast cancer in patients in relation to dosage of coenzyme Q10. *Biochemical and Biophysical Research Communications*, Vol. 199, 1994, pp. 1504-08
 36. Judy, W.V., et al. Coenzyme Q10 reduction of adriamycin cardiotoxicity. In *Biomedical and Clinical Aspects of Coenzyme Q*, Vol. 4, eds. Folkers, K. and Yamamura, Y., Amsterdam, Elsevier, 1984, pp. 231-41
 37. Mindell, Earl. *Earl Mindell's Vitamin Bible*, NY, Warner Books, 1991, p. 289
 38. Balch, James F. and Balch, Phyllis A. *Prescription for Nutritional Healing*, Garden City Park, NY, Avery Publishing Group Inc., 1990, p. 11

This article was also published in the *International Journal of Alternative and Complementary Medicine*, Vol. 16, No 2, February 1998, pp. 11-12