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Complementary Medicine

Coenzyme Q₁₀ – does it have a role in diabetes management?

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INTRODUCTION Coenzyme Q₁₀ (COQ₁₀) is present in the cell mitochondria and plays a key role in the production of cellular energy. It is present in high levels in the heart, liver and kidneys. COQ₁₀ is manufactured in the body; thus supplements are not needed unless COQ₁₀ becomes depleted, as can occur in various health conditions, with some medicines and environmental factors. COQ₁₀ is present in foods such as oily fish, meat, nuts and some oils. Lower amounts are present in dairy foods, vegetables, fruit and cereals.

Actions
COQ₁₀ assists in replenishing cellular energy by generating adenosine triphosphate (ATP) in mitochondria. ATP is the basic energy molecule in cells. It is primarily transported in the blood by low and high density lipoproteins (LDL and HDL). It also helps regulate insulin secretion from beta cells. COQ₁₀ limits the speed at which glucose is processed into energy in cells. If COQ₁₀ is depleted, the energy is directed towards oxidation in the mitochondria, which depletes important antioxidants and contributes to oxidative tissue damage. COQ₁₀ is an antioxidant and can be depleted when LDL is oxidised.

COQ₁₀ and diabetes and cardiovascular disease
Diabetes is associated with insulin resistance (type 2 diabetes mellitus), hypertension, congestive heart failure (CHF) and endothelial dysfunction. In addition, people with diabetes are often deficient in COQ₁₀. The role of COQ₁₀ in contributing to metabolic abnormalities has been extensively researched and is supported in rare types of diabetes caused by genetic mutations in the mitochondria, for example, mtDNA mutations that lead to mitochondrial and beta cell dysfunction. The incidence of mtDNA 3243 is low, <1%, however, a specific mtDNA mutation, 3243, leads to type 2 diabetes and deafness. COQ₁₀ supplements in type 2 diabetes mellitus with mtDNA mutations have improved wellbeing and energy and reduced pimplations and leg cramps but glycaemic control did not improve. A three year trial involving people presenting with family history of type 2 diabetes mellitus, deafness, glucose intolerance and the mtDNA 3243 mutation, and matched controls showed no difference between the groups after three months. However, after three years the control group had reduced insulin secretion, worsening deafness and lower exercise tolerance than the COQ₁₀ group. The difference was significant: deafness (p = 0.02), exercise (p = 0.001), insulin secretion (p = 0.02).

Researchers involving people with mtDNA 3243 does not necessarily apply to all people with diabetes although mitochondrial changes also occur in other types of diabetes. For example, Eriksson et al did not find any significant change in glycaemic control, blood pressure and lipids between COQ₁₀ and placebo in a six month randomised controlled trial (n = 23), but serum COQ₁₀ levels rose significantly.

Likewise, a clinical trial in type 1 diabetes (n = 34) was undertaken after several people reported COQ₁₀ supplements enabled them to lower their insulin doses. Participants were randomly assigned to 100mg of COQ₁₀ daily or placebo for 12 weeks.

There were no significant differences between the two groups in total insulin dose, glycaemic control or general wellbeing. However, COQ₁₀ supplementation has been shown to have a number of clinically significant benefit related to diabetes management. These include:

• Improved cellular and mitochondrial function in cardiomyocytes, which improves cardiovascular status generally and especially before, during and after cardiac surgery. For example, improved postoperative cardiac function, reduced myocardial structural damage when COQ₁₀ is administered preoperatively and administered within three days after myocardial infarction.

• At least five clinical trials suggest COQ₁₀ helps control hypertension where systolic blood pressure reduced by 17mmHg and diastolic by 10mmHg. Lower doses of antihypertensive medicines in 50% of participants using an average COQ₁₀ dose 225mg daily for 4.4 months however, it takes a few weeks before these effects occur.

• Improved endothelial function in the peripheral circulation, with reduces oedema, which improves exercise tolerance and wellbeing.

• Improved quality of life, exercise tolerance and ejection fraction in people with cardiac disease and improved breathing in people with chronic heart failure, and fewer hospital admissions in people receiving 200mg COQ₁₀ per day (n = 32) for 12 months. However, other researchers found no significant improvements.

• Reduced oxidative stress in people...

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• A small but significant reduction in HbA₁c (0.4%) using 200mg CoQ₁₀ per day in people with type 2 diabetes mellitus.¹⁷
• Faster healing and reduced pain associated with periodontal disease, but most studies are old and not well designed.¹³

Recommended doses and dose forms
CoQ₁₀ is available in a range of doses between 10–300mg and in a number of dose forms: soft gel capsules, hard shell capsules, oral spray and tablets. It is also added to several cosmetic products. Recommended doses range between 30–300mg per day but average 50–100mg per day. Higher doses are not generally recommended except in specific circumstances for short periods of time and then under the direction and supervision of qualified practitioners.

Soft gel capsules appear to be absorbed better than other dose forms²⁶ for example, blood concentrations 2–3 times higher than other dose forms have been reported.²⁶ CoQ₁₀ is fat-soluble and should be taken with a meal containing some fat to aid absorption. Likewise, taking it with food may improve absorption.

Precautions
Recommended for all ages except those with contraindications.
Supervised by professional health care practitioners.
People with liver disease, cardiovascular conditions, and diabetes require caution.

Medications that deplete CoQ₁₀ levels
Medications that lower endogenous CoQ₁₀ include:
• Statins such as lovastatin, pravastatin and simvastatin.
• Fibrin acid derivatives such as gemfibrozil.
• Beta blockers such as atenolol, labetolol and propranolol.
• Tryptic antidepresants such as amitrupline, doxepin and imipramine.

However, more research is needed to determine whether CoQ₁₀ supplements have a role as adjunctive therapy with these medicines.

Summary
CoQ₁₀ is an important energy cofactor and appears to improve cardiovascular health. There is good evidence that CoQ₁₀ has beneficial effects on vascular function and blood pressure, two key complications of diabetes responsible for a great deal of the morbidity and mortality associated with diabetes.

Research and anecdotal evidence suggest CoQ₁₀ can be used safely by people with type 2 diabetes mellitus; however, there may be additive effects when it is used with glucose lowering and antihypertensive medicines.

If people use CoQ₁₀, they should monitor their blood glucose and blood pressure and inform their health care professionals who should document it in the individual’s medication record.

The cost of CoQ₁₀ needs to be considered and may be prohibitive for some people. If CoQ₁₀ is used it should be within the Quality use of Medicines framework and careful monitoring of effectiveness and medicine interactions; both beneficial and adverse, is important.

References
7. Andersen C. The effect of coenzyme Q₁₀ on blood glucose and insulin requirements in patients with insulin dependent diabetes mellitus.