

Vitamin K2 & CoQ10: Important Heart Health Nutrients

The heart is one of the hardest-working organs in your body. It contracts and relaxes a little more than once per second, providing the blood flow that every other organ in your body relies on. That requires a steady supply of energy, and to perform at optimal function, your heart needs to be able to derive that energy from its fuel (primarily fatty acids and glucose) efficiently and with little waste. This is where Coenzyme-Q10 (CoQ10) comes into play.

Meanwhile, for the heart to operate optimally, the blood vessels and arteries need to be healthy and flexible. But as we age, calcium in the bloodstream can accumulate as it deposits in the artery walls, causing them to stiffen. This can result in reduced blood flow, increasing blood pressure and the formation of microfractures that can give way and even fissure. And this is where Vitamin K2 enters the picture.

Not only do Vitamin K2 and CoQ10 provide similar support to the heart and blood vessels, but there is a staple of traditional medical treatment for cardiovascular health that actually works against both of these vital nutrients.

Vitamin K2

Affect on Heart Health: The body produces Matrix Gla Protein (MGP), a K-dependent protein that is the most potent natural inhibitor of calcification known today.¹ But in order to perform this function, MGP needs to be activated. When the body has adequate Vitamin K2 (specifically as menaquinone-7, or MK-7, as it is the most biologically active and available form of Vitamin K2), MGP repels calcium from depositing in the arteries and blood vessels, returning it to the bloodstream so it can be utilized by other systems, such as building strong, dense bones.

A 3-year study (using a specific brand of Vitamin K2 as MK-7) on 244 healthy postmenopausal women provided a breakthrough demonstration of Vitamin K2's affect to heart health. The group was randomly assigned to take a nutritional dose (180 mcg) of Vitamin K2 as MK-7 daily for 3 years, or placebo capsules. After three years of treatment, the Stiffness Index β in the MK-7 group had decreased significantly after compared to the slight increase in the placebo group. Results confirmed that vitamin K2 as MK-7 not only inhibited age-related stiffening of the artery walls, but also made a statistically significant improvement of vascular elasticity.

This study is the first intervention trial where the results confirm the association made by previous population-based studies: that vitamin K2 intake is linked to cardiovascular risk. According to the researchers, the data demonstrated that a nutritional dose of vitamin K2 in fact promotes cardiovascular health.²



Mechanism of Action: Vitamin K is not a single compound. It consists of a group of fat-soluble vitamins that are essential for the body to have normal coagulation activity, to utilize calcium for healthy bones, arteries and soft tissues. The vitamin K family is divided into vitamin K1 – one molecule (phylloquinone) and vitamin K2 – a group of molecules (menaquinones).

While both Vitamin K1 and Vitamin K2 are responsible for blood clotting, due to its molecular structure, it is Vitamin K2 that is available and can be utilized by soft tissues and systems beyond the liver.

K vitamins play an essential role as cofactor for the enzyme γ -glutamyl carboxylase, which is involved in carboxylation of the vitamin K-dependent proteins – specifically, the conversion of peptide-bound glutamic acid (Glu) to γ -carboxy glutamic acid (Gla).

Carboxylation, or activation, of vitamin K-dependent proteins (called Gla-proteins) serves as a recycling pathway to recover vitamin K from its epoxide metabolite (KO) for reuse in carboxylation. Several human Gla-containing proteins synthesized in several different types of tissues have been discovered. But specific to cardiovascular health, Matrix gla protein (MGP) is calcification inhibitory protein found in numerous body tissues, but its role is most pronounced in cartilage and in arterial vessel walls.

Vitamin K2 activates clotting factors, MGP and osteocalcin – proteins produced in the liver, bone and vasculature, which coagulate blood, “clean up” calcium deposits stored in the arteries and bind it to the surface of bone. The activation occurs via carboxylation reaction, in which vitamin K acts as a cofactor for γ -glutamyl carboxylase – an enzyme transforming proteins’ Glu residues into Gla, which gives them an ability to bind calcium ions. Then Vitamin K2 is being recycled, which allows the body to reuse it.

Heart-Health Benefit: By helping the arteries and blood vessels to remain healthy and flexible, Vitamin K2 supports cardiovascular health, improving endothelial function (the vasculatures ability to relax and contract) and protecting against atherosclerosis (a disease of the arteries characterized by the deposition of plaques of fatty material on their inner walls).

CoQ10

Affect on Heart Health: CoQ10 is essential for the heart to maintain sufficient energy management.^{3,4} But when CoQ10 levels decline, tissues burn fuel inefficiently, eventually producing oxidative damage and ultimately losing their function. When the heart muscle loses its fuel efficiency, heart failure may occur.^{3,4}

Studies show that CoQ10 supplementation at 300 mg/day not only restores normal CoQ10 levels, but prevents progression of heart failure and, in fact, can reverse that progression and extend survival and improve quality of life.



Similar beneficial effects have now been shown in patients with endothelial dysfunction, hypertension, and coronary artery disease, the precursors of heart attacks and, ultimately, heart failure.

Mechanism of Action: CoQ10 is a fat-soluble, vitamin-like compound that is naturally found in most tissue of the human body. The highest concentrations are found in the heart, liver, kidney, and pancreas. The human body produces CoQ10, yet we can replenish it from dietary sources. Within the cell, CoQ10 is mostly present in the mitochondria (40-50%). It is the electron acceptor for the mitochondrial electron transport chain. It is also a cofactor used in processes of aerobic respiration, aerobic metabolism, oxidative metabolism, and cell respiration.

CoQ10's primary function is as an antioxidant, membrane stabilizer and production of adenosine triphosphate (ATP) in the oxidative respiration process. As an antioxidant and its role in ATP, CoQ10 offers many therapeutic benefits. Also, coenzyme Q10 has been shown to help preserve myocardial sodium-potassium ATPase activity and stabilize myocardial calcium dependent ion channels.

Heart Health Benefit: Chronic oxidative stress is one of the main factors reducing the functioning of the endothelium, the thin layer of cells lining arteries that controls blood flow and pressure. *Endothelial dysfunction* is a major precursor to hypertension, coronary heart disease, and strokes. As a unique antioxidant, CoQ10 reduces blood vessel stiffness, which is a consequence of endothelial dysfunction.

In patients with known coronary artery disease, who are at high risk for heart attack, and who need every bit of functioning endothelium, supplementation with **300 mg** of CoQ10 a day significantly improved their natural endothelial antioxidant levels, improved their arterial relaxation, and improved their oxygen utilization.⁵

Further, oxidative stress and endothelial dysfunction are major causes of elevated blood pressure. CoQ10 supplementation is showing promise in reducing blood pressure in hypertensive patients, without producing dangerous abrupt drops in pressure.

Connection: Endothelial & Statins

Both Vitamin K2 and CoQ10 have been shown to improve endothelial function, but that is not the only connection tethering these vital nutrients.

Statins are a common recommendation for lowering LDL-C levels (cholesterol), and their use has been on the rise over the last few decades, even though it is commonly known that statins deplete CoQ10 levels in the body. In response, it is recommended to patients on statins to offset the side effect by taking supplemental CoQ10.

However, a paper recently published in *Expert Review Clinical Pharmacology*⁶ that states that statins may act as “mitochondrial toxins” with negative effects on the heart and blood vessels not only via the depletion of coenzyme Q10 (CoQ10), but also by inhibiting “the synthesis of



vitamin K2, the cofactor for matrix Gla-protein activation, which in turn protects arteries from calcification.”

This new paper speaks directly to statins interrupting the mechanism of action by which vitamin K2 inhibits calcification. Yet while CoQ10 and Vitamin K2 are both affected by statins, no recommendation currently exists for supplemental Vitamin K2 to be given to statin patients. That is something that the medical community needs to consider.

References:

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