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Review Article

COQTEN-100 Tablets–An Intercellular Antioxidant

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ABSTRACT

Mitochondrian of the cells play a vital role in the production of energy at cellular level which is essential for the survival of a cell. CoQ10 is one of the coenzyme in the electron transport chain in the inner mitochondrial membrane where oxidative phosphorylation occurs for the production of ATP from the reducing equivalents such as NADPH2, FADH2, etc. Besides, CoQ10 works as an antioxidant, protecting lipids and other cell components from oxidation. Thus, it is a particularly promising cardioprotective agent. Apart from this there are so many functions of CoQ10 which are vital for the sustenance of life. When cells age, mitochondrial CoQ10 levels decrease. But dietary supplementation has been shown to help, maintain energy production and aid persons against disorders of CoQ10 deficiency disorders. This review gives an overview of functions of the CoQ10, reports related to consumption versus alleviation of diseases and its importance of dietary supplement in now a days life.

Keywords: CoQ10, Energy Production, Nutrient.

1. INTRODUCTION

CoQ10 is an enzyme which is naturally found in many cells of the body. In fact, it is found in every single mitochondrial cell and about 95% of our body's energy is produced by this way, which converts sugars and fats into energy. It is a component of electron transport chain of inner mitochondrial matrix and participates in the respiration ultimately generating the energy in the form of ATP. Some of the organs such as heart, liver and kidneys have the highest concentrations of CoQ10 as these organs need a lot of energy for their functioning.

1.1 CoQ10

CoQ10 structure consists of a benzoquinone with an isoprenoid side chain attached at sixth carbon. CoQ10 can give up electrons easily thus acting as a powerful antioxidant against free radical [8]**.** CoQ10 along with vitamin E increases the resistance of LDL to oxidation and prevents coronary heart disease [9]. Ageing also occur due to decline in levels of CoQ10. HMG-CoA reductase inhibitors like lovastatin, simvastatin can cause CoQ10 deficiency [11]. Researchers revealed that 2.5ug/ml or preferably 3.5ug/ml is required to have a good impact on severely diseased heart [12]. A study was done on 109 patients suffering from hypertensive heart diseases and isolated dysfunction. On replacement of CoQ10 there occurred lowering of elevated blood pressure, improvement in diastolic function and a decrease in myocardial thickness in 53 percent of patients [13]. Diastolic dysfunction is more common in women than in men. So, CoQ10may offer a 'gender advantage' for aging women [14]. An early research suggested that mitral valve prolapse might be associated with CoQ10 deficiency [15].

CoQ10 was first isolated by Frederick Crane in 1957 from beef heart. Q-indicates its membership in quinone group and Fig.1 indicates the no. of isoprenoid units and its side chain [1]. It was named as ubiquinone by Dr. R.A. Mortan because of its wide spread availability in living organisms [2]. Dr. Y.Yamamura was the person who organized clinical trial of CoQ10 in human subjects for the first time. A year later, they demonstrated CoQ10

deficiency in case of human heart diseases [3]. In 1978 Peter Mitchell was awarded Nobel prize for CoQ10 and energy transfer [4]. In 1985 Per langsjoen tested CoQ10 in double-blind fashion and reported it as a valuable nutrient for cardiomyopathy [5]. Larsernster found that CoQ10 acts as a free radical scavenger [6].

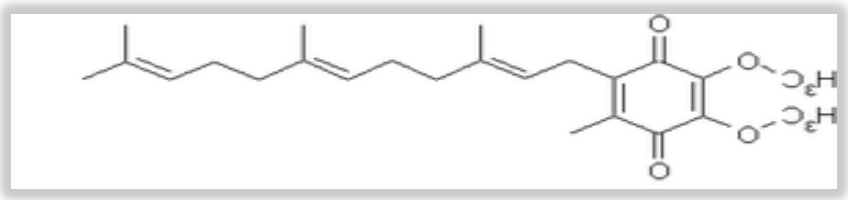


Figure 1: Coq10 Structure

Composition

2. COQ10 AND ITS IMPLICATION IN DISEASE STATES

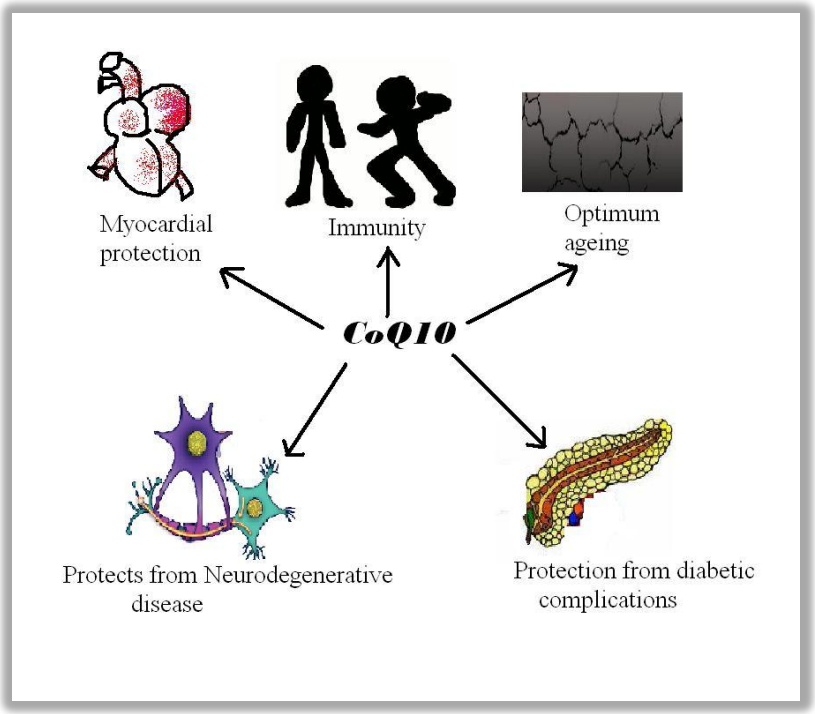
a) Cardiovascular diseases

Arrythmia

An experimental study was conducted on rabbits. In this, rabbits were given CoQ10 before ligation procedure. On isolation of cellular mitochondria 40 minutes after tying a major blood vessel to heart muscle, higher levels of free radicals and lower levels of CoQ10 were identified. Degree of oxidative damage reduced proportionately due to pretreatment with CoQ10 dosage [16]. A study was conducted on 27 patients with premature ventricular ectopic beats; the reduction in premature ventricular contractions (PVC) activity was significantly greater after 4-5weeks of coq10 administration. Although CoQ10 antiarrythmic effect was primarily seen in diabetics. Also a significant reduction of palpitations was noted for hypertensive otherwise healthy patient [17].

Myocardial `Protection in Cardiac Surgery

CoQ10 supplementation in pre-operative cardiac patients improved right and left ventricular myocardial ultrastructure, which was measured by light microscopy both pre and postoperative [18]. Researches even revealed that pretreatment with CoQ10 are effective in preserving heart function following coronary artery bypass surgery (CABG) and valvular surgery [19]. Naylar worked with rabbit heart model of coronary insufficiency and reperfusion, presented with CoQ10 role in preserving an oxygen deficient myocardium [20].



Atherosclerosis and Lipid Peroxidation

CoQ10 has a unique ability to recycle vitamin E which has tremendous treatment implications, especially when it showed to block lipid peroxidation [21]. CoQ10 can decrease lipid peroxidation in healthy well-nourished adults and in those with arteriosclerotic plaque [22].

b) Thyroid, Adriamycin and CoQ10

Research by Suzuki indicated a direct relationship between cardiac performance and CoQ10 supplementation in patients with thyroid disorders [23]. Kishi and colleagues performed an animal study which revealed that the administration of CoQ10 was more protective against the damage induced by Adriamycin when compared to vitamin E alone [24]. A rat model is treated with Adriamycin, the administration of CoQ10 restored blood levels to normal range and prevented ADRIAMYCIN-induced structural changes in the heart [25].

c) Optimum Aging

The free radical theory of aging (1956) stated that free radical reaction, modified by genetic and environmental factors were responsible for the aging and death of all living organisms [26]. Age-related decline in CoQ10 levels is observed both in animals and humans [27]. CoQ10 can prevent oxidative stress induced apoptosis (cell death) by inhibiting lipid peroxidation in plasma membrane [28].

d) Immunity and Defense

A study was conducted on 6 patients with AIDS or AIDS-related complex who were treated with 200mg of CoQ10 daily. T-cell immunity increased in 3 patients and 5reported symptomatic improvement [29].

e) Cancer

In a study, 83 patients in the United States who had cancer of the breast, lung, prostate, pancreas, colon, stomach, rectum and other sites were found to have deficiency of CoQ10 in blood [30].

f) Periodontal Diseases

Several studies revealed that oral administration of CoQ10 to patients with periodontal diseases was effective in suppressing inflammatory changes in gingival which was assessed by gingival index, pocket depth and tooth mobility scores [31].

g) Neurodegenerative Disorders

In a study reported in the New England Journal of Medicine, Alzheimer's patients with nutritional support of vitamin E along with CoQ10 showed a reduction in the progression of their disease [32]. Human brains experience a progressive reduction in levels of CoQ10 along with neurotransmitters during ageing process [33]. Fallon and colleagues conducted a study on rats and confirmed that administration of CoQ10 along within cotinamide blocks toxin-induced damage to substantia nigra [34]. Supplemental CoQ10 increased NADH oxidation at mitochondrial level which acts as an electron acceptor for plasma membrane –associated NADH dehydrogenase [35].

h) Diabetes

Research revealed that diabetic patients with very low levels of CoQ10 are highly prone to death from congestive heart failure within a narrow time period [36].

i) Chronic Obstructive Pulmonary Disease (COPD)

Fujimato's data revealed that CoQ10 supplementation has favorable results on chronic obstructive pulmonary disease patients, who have low oxygen levels at rest and during exercise [37]. A study conducted in Stockholm, Sweden revealed that patients with COPD and coronary heart disease had deficiencies in the levels of vitamin E and CoQ10 in plasma and lower leg muscles tissues which might be the result of malnutrition but also suggested depressed resistance to cell trauma [38].

j) Damaged Skin

At the ninth International Symposium on Biomedical and Clinical Aspects of CoQ10, Poda and Parker proposed that Coq10 was the first antioxidant to be affected by oxidative stress in the skin. They hypothesized that CoQ10 could be a sensitive marker to evaluate the antioxidant capacity of topically applied sunscreens and even to measure the effect of exposure to UV in our day to day life [39]. A presentation at International CoenzymeQ10Association Conference in Boston (May 1998) suggested that "fountain of youth" effect may be due to hydration of the skin in combination with the improvement of hyaluronic acid synthesis by CoQ10 [40].

k) Infertility

Research demonstrated that sperms rely on additional energy for motility which may be actually dependent on bioenergetics function of CoQ10 [41].

l) Athlete

Researchers speculated that high metabolic stress and elevated levels of radical formation in marathon runners along with lower CoQ10 and vitamin E levels were indication of a continuing drain on their antioxidants cavenging potential [42]. Marathon runners who were pretreated with CoQ10 had lower plasma levels of tissue breakdown products compared to their controlled counter parts [43].

m) Muscular Dystrophy

Folker suggested that any patient suffering from muscular dystrophy should be treated with CoQ10 indefinitely [44].

n) Mitochondrial Encephalopathy

In a study, 6 patients suffering with mitochondrial cytopathies were treated with 150mg of CoQ10 over 6 month period showed improvement in brain variables and muscle mitochondrial function [45].

3. INDICATIONS

- CHF
- ARRHYTHMIAS
- PARKINSONISM
- CANCER
- DIABETES
- MALE INFERTILITY
- CARDIOMYOPATHY

3.1 CoQ10 in dietary substances

CoQ10 richest food is sardine and mackerel followed by reindeer muscle meat, pork and beef heart, liver etc. and its quantity varies in other meat substances. Even though plants does not have reasonable amount of CoQ10, some of the plant materials such as broccoli, spinach, soy products, peanuts can improve the CoQ10 levels in the body. CoQ10 levels may be lost by frying or firing. While boiling, food should not be over cooked to spare CoQ10 levels. Canned foods have very low level of CoQ10 when compared to fresh and unprocessed food items. As CoQ10 is a fat soluble substance, it should be taken along with olive or soy bean oil or any other fat substance for a maximum benefit. Dose of the CoQ10 varies according to the health conditions of the person.

4. DOSAGE

- A normal person should have 30 to 60mg.
- Cancer patients - 200 to 600 mg per day.
- Cardiac related problems - 360 mg per day.
- Diabetic patients- 200 mg per day

5. LIMITATIONS OF COQ10

- As the biosynthetic pathway for cholesterol and CoQ10 are same, the statin drugs (cholesterol lowering drugs) which are aiming at HMG CoA reductase also reduce the CoQ10 levels in the body.
- CoQ10 may reduce the body's response to blood thinners such as warfarin and therefore should be taken according to the directions of physicians.
- Blood pressure lowering drugs such as beta blockers also has lowering effect on CoQ10. So, these drugs are supplemented with dietary substitutes.

6. CONCLUSION

CoQ10 is vital compound that keeps the body's metabolism going on. Unfortunately, many doctors will not prescribe it as the dietary supplement for cardiac patients. Though the rationale for CoQ10 in the treatment of wide variety of diseases has been published in a number of studies, it is not used unto its potential. Without a doctors support, the versatility of the CoQ10 in its functions cannot be capitalized for its therapeutic benefits. Though CoQ10 may not guarantee accurately, it has shown its vast lifesaving potential in selected patients. Related reports of inefficiency of CoQ10 are due to deficiency of other nutrients, enzymes, B vitamins, minerals and cofactors which are necessary for its biosynthesis and utilization by the body.

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