

## Effects of Coenzyme Q10 on Blood Biochemistry in Rats

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### Summary

Coenzyme Q10 (CoQ10) is used as a food supplement and as an ethical drug because of its antioxidant functions and key role in mitochondrial bioenergetics. In this study, the effects of CoQ10 on blood biochemistry and malondialdehyde (MDA) levels in rats were investigated. Ten male Wistar rats ages ranging between 7 and 8 weeks were used. All animals were kept under the same condition and were given free access to standard rat chow and tap water ad libitum. The CoQ10 treated rats received daily administrations of 10 mg/kg body weight of CoQ10 by oral gavage for 10 days. Control rat groups were treated in an identical fashion with oil. The measurement of biochemical parameters; sera glucose, triglyceride, cholesterol, total protein, albumin, ALT, ALP, BUN, creatinin, calcium, magnesium, phosphorus, iron and plasma malondialdehyde levels were analysed. In CoQ10 treated rats, decreased levels of ALP and increased levels of P in serum were found compared to levels in control rats. The other parameters analyzed in the serum were not significantly different between control and CoQ10 treated rats at dose of 10 mg/kg BW for 10 days. No major effects on the parameters investigated in this study were observed following coenzyme Q10 treatment.

**Keywords:** *Coenzyme Q10, Blood parameters, Rat*

## Koenzim Q10'un Ratlarda Kan Biyokimyasına Etkileri

### Özet

Koenzim Q10 (CoQ10), antioksidan fonksiyonu ve mitokondrial biyoenerjetik anahtar rollerinden dolayı gıda takviyesi ve ilaç olarak kullanılmaktadır. Bu çalışmada, CoQ10'un ratlarda kan biyokimyası ve malondialdehit düzeylerine etkisi araştırılmıştır. 7-8 haftalık 10 erkek rat çalışmada kullanılmıştır. Tüm hayvanlar aynı şartlarda tutulmuş ve ad libitum standart rat yemi ve su verilmiştir. CoQ10, 10 gün süreyle oral yoldan gavaj ile günde 10 mg/kg canlı ağırlık dozunda uygulanmıştır. Kontrol grubuna ise aynı yolla taşıyıcı sıvı yağ uygulanmıştır. Biyokimyasal parametrelerden serum glukoz, trigliserid, kolesterol, toplam protein, albümin, ALT, ALP, BUN, kreatinin, kalsiyum, magnezyum, fosfor, demir ve plazma malondialdehit düzeyleri analiz edilmiştir. CoQ10 uygulanan ratlarda kontrol grubuyla karşılaştırıldığında serum ALP düzeylerinde azalış, P düzeylerinde ise artış bulunmuştur. Analiz edilen diğer parametrelerde ise kontrol grubuna göre CoQ10 uygulanan ratlarda önemli bir farklılık bulunmamıştır. Çalışmada, CoQ10 uygulamasını takiben araştırılan parametrelerde önemli bir etki gözlenmemiştir.

**Anahtar sözcükler:** *Koenzim Q10, Kan parametreleri, Rat*

### INTRODUCTION

Coenzyme Q (2-methyl-5,6-dimethoxy-1,4-benzoquinone), soluble natural fat quinone, is a ubiquitous and endogenous lipid-soluble antioxidant found in plant as well as in humans and animal organisms. CoQ10 is crucial to optimal biological function. It is a component of the oxidative phosphorylation process in mitochondria that converts the energy in fatty acids and

carbohydrates into ATP to drive cellular synthesis <sup>1</sup>.

Neurodegenerative disorders, cancer, cardiovascular diseases and diabetes mellitus and especially aging and Alzheimer's disease exhibit altered level of CoQ10, indicating its likely crucial role in the pathogenesis and cellular mechanisms of these ailments <sup>2</sup>. CoQ10 acts both as an anti-



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oxidant and as an electron acceptor at the level of the mitochondria <sup>3,4</sup>.

CoQ10 is biosynthesized and concentrated in the heart, kidneys, liver, muscle, pancreas and thyroid gland. The content of CoQ10 in organs decreases with age <sup>5</sup>. CoQ10 is used as a food supplement and as an ethical drug because of its antioxidant functions and key role in mitochondrial bioenergetics <sup>3</sup>. Therefore it is now widely used as a therapeutic substance to treat a variety of disorders such as ischemic heart disease, Parkinson's disease and diabetes mellitus <sup>6-8</sup>. Its supplementation has been touted to improve physical and athletic stamina, muscle fatigue and weakness <sup>8</sup>.

The aim of present study was to evaluate the effects of CoQ10 on blood biochemistry in rats. In addition, its effects on malondialdehyde (MDA) levels were also investigated.

## MATERIAL and METHODS

### Animals and Treatments

Ten male Wistar rats' ages ranging between 7 and 8 weeks and weighting about 200 to 320 grams were used. All animals were kept under the same condition, room temperature and lighting (12:12 h. dark: light) for 3 weeks before the start of the experiment and were given free access to standard rat chow and tap water ad libitum. The animals were divided into two groups (each group consisted of five animals). There were no statistically significant differences concerning initial body weights between the two groups.

The CoQ10 treated rats received daily administrations of 10 mg/kg body weight of CoQ10 by oral gavage for 10 days. Control rat groups were treated in an identical fashion with oil. On day 10, blood samples were collected after an overnight fasting by cardiac puncture from anesthetized animals [Ketamine chloride (10 mg/kg BW, IM) and Sodium pentobarbital (30 mg/kg BW, IP)]. All animal procedures were approved by *Animal Ethics Committee of Veterinary Faculty of Ankara University*.

CoQ10 used in this study was Solgar provided by Solgar Vitamins Incoorporation, Istanbul and each capsules contains 30 mg CoQ10 (Batch No: 60232711). CoQ10 were dissolved in oil prior to daily administrations.

### Biochemical Analysis

The measurement of biochemical parameters; sera glucose, triglyceride, cholesterol, total protein, albumin, ALT, ALP, BUN, creatinin, calcium, magnesium, phosphorus and iron were analyzed by biochemical analyzers (Abbot Alcyon 330i, USA).

The malondialdehyde levels, as an index of lipid peroxidation was determined by thiobarbituric acid (TBA) reaction according to the Yoshioka et al.<sup>9</sup>.

### Statistics

All values are expressed as mean±SD. Mann-Whitney test was applied to analyze the significance of differences between mean values and a critical P- values was considered to be significant at <0.05.

## RESULTS

Plasma MDA levels were 34.22±12.85 nmol/ml and 59.84±24.16 nmol/ml for control and CoQ10 treated rats, respectively. The plasma MDA levels were found insignificantly increased in CoQ10 treated rats compared to the control rats. The MDA levels of the control and CoQ10 treated rats are shown in *Table 1*.

**Table 1.** Blood biochemical parameters in control and CoQ10 treated rats (n=5, X±SD)

**Tablo 1.** Kontrol ve CoQ10 verilen ratlarda kanda biyokimyasal parametreler (n=5, X±SD)

Parameters	Control	CoQ10 10 mg/kg
Glucose (mg/dl)	100.8±27.01	94.8±20.16
Triglyceride (mg/dl)	98.8±67.92	86±47.44
Cholesterol (mg/dl)	30.0±5.24	28.8±3.11
Total Protein (g/dl)	5.46±0.29	5.42±0.34
Albumin (g/dl)	3.4±0.20	3.38±0.13
ALT (IU/L)	33.0±3.94	87.6±83.65
ALP (IU/L)	297.4±51.33	237±60.17*
BUN (mg/dl)	16.2±7.49	15.3±7.25
Creatinin (mg/dl)	1.02±0.08	1±0.17
Ca (mg/dl)	10.66±0.65	12.34±2.65
Mg (mg/dl)	2.9±0.50	3.12±0.93
P (mg/dl)	10.8±2.76	16.84±5.90*
Fe (mg/dl)	171.4±48.87	162.4±59.68
MDA (nmol/ml)	34.22±12.85	59.84±24.16

\* P<0.05

*Table 1* also shows data from blood biochemistry. Parameters analyzed (except serum ALP and P) in the serum were not significantly different between control and CoQ10 treated rats at dose of 10mg/kg

BW for 10 days. In CoQ10 treated rats, decreased levels of ALP and increased levels of P in serum were found ( $P < 0.05$ ).

## DISCUSSION

The decreased biosynthesis of CoQ10 and its deficit in tissues is associated with degenerative changes of aging. Therefore, CoQ10 dietary supplementation has become helpful for organism and recently it is used for daily health care worldwide.

Recent studies found CoQ10 due to its antioxidant activity modified the biochemical changes occurred during experimental chemically induced diabetes<sup>10</sup>, gentamicin nephrotoxicity<sup>11</sup>, rhabdomyolysis<sup>12</sup> in rats. The beneficial effect of CoQ10 depends on its antioxidant property<sup>1,3</sup>. Modi et al.<sup>10</sup>, observed significant decrease in elevated levels of glucose, cholesterol, triglycerides, VLDL, LDL and atherogenic index and increased HDL-cholesterol levels in diabetic rats with CoQ10 treatment. Reduced lipid peroxidation and increased antioxidant parameters also found in the liver homogenates of diabetic rats with CoQ10 treatment.

CoQ10 supplementation had decreased oxidative stress as measured by MDA levels in healthy men<sup>13</sup>. Its reduced form, ubiquinol, inhibits protein and DNA oxidation. Dietary supplementation with CoQ10 results in had increased levels of ubiquinol-10 within circulating lipoproteins and increased resistance of human low-density lipoproteins to the initiation of lipid peroxidation<sup>3</sup>. In this study, treatment with CoQ10 for 10 days caused insignificantly increased plasma MDA levels in rats. The reason of insignificantly increased of plasma MDA levels may be related with ubisemiquinone radical. Antioxidant action is a property of the reduced form of CoQ10, ubiquinol (CoQ10H<sub>2</sub>) and the ubisemiquinone radical (CoQ10H<sup>•</sup>-). Paradoxically, independently of the known antioxidant properties of CoQ10, the ubisemiquinone radical anion possesses prooxidative properties<sup>4</sup>.

Creatinine and urea are compounds derived from protein, which are eliminated by the kidney. In rats treated with CoQ10 did not change urea nitrogen and creatinine levels suggesting no alterations in kidney function. Liver enzymes, such

as ALT (AST, not specific for rats) and ALP were found within the physiological range. However, The serum ALT levels were found insignificantly increased in CoQ10 treated rats ( $87.6 \pm 83.65$  IU/L) compared to the control rats ( $33.0 \pm 3.94$  IU/L) and significantly decreased serum ALP levels were found in CoQ10 treated rats ( $237.0 \pm 60.17$  IU/L) compared to the control rats ( $297.4 \pm 51.33$  IU/L). Liver efficiently accumulates exogenous CoQ10 when administered orally<sup>5,14</sup>.

The serum P levels were found significantly increased in CoQ10 treated rats ( $16.84 \pm 5.90$  mg/dl) compared to the control rats ( $10.8 \pm 2.76$  mg/dl). But the differences of serum P levels also were found within the physiological range.

In conclusion, no major beneficial effects on the parameters investigated in this study were observed following coenzyme Q10 treatment. However, because the results of this study were derived from a small number of animals, the interpretation of the results should be retested in further larger doses and longer supplementation times with a larger scale study to confirm the present finding.

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