

Total Blood Cholesterol, HDL-Cholesterol and Serum Zinc Levels in Cardiovascular Disease

Kalp-Damar Hastalıklarında Total Kan Kolesterol, HDL-Kolesterol ve Serum Çinko Düzeyleri

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SUMMARY

Serum zinc, total blood cholesterol and HDL-cholesterol levels were studied in male and female patients who suffer from cardiovascular diseases (CDV). There was an increase in total blood cholesterol and HDL-cholesterol and serum zinc levels of patients compared to the controls. The difference was significant for total blood cholesterol ($p < 0.001$ for male and female), HDL-cholesterol ($p < 0.05$ for female and $p < 0.001$ for male) and serum zinc level ($p < 0.05$ for female and $p < 0.001$ for male). Because of the drug therapy HDL-cholesterol levels of the patients were higher than control. These results show that high serum zinc level of patients is a risk factor for CVD as well as total blood cholesterol level.

ÖZET

Bu çalışmada, kardiyovasküler rahatsızlıkları olan kadın ve erkek hastalarda total kan kolesterolü, HDL-kolesterolü serum çinko düzeyleri ölçülmüştür. Total kan kolesterolü ile HDL kolesterolü ve serum çinko düzeylerinde kontrol gruplarına göre yükselme bulunmuştur. İlaç tedavisinde olmaları nedeniyle hastalarda HDL-kolesterol düzeyleri kontrollerden yüksek bulunmuştur.

Sonuçlar, kolesterol düzeyi yanında çinko düzeyinin yükselmesinde kardiyovasküler hastalıklar yönünden bir risk oluşturduğunu göstermektedir.

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It has been known that elevated blood cholesterol, cigarette smoking and hypertension are the risk factors related to coronary heart diseases (1). The distribution and transport of cholesterol in blood may be associated with the risk of developing coronary heart disease. Especially high density lipoprotein (HDL) appears to be an important predictor of the possibility of developing heart diseases (2,3). The higher proportion of HDL, the lower the risk of developing heart diseases. In general, the blood concentrations of HDL-cholesterol are high in children, decrease with age and are the lowest in sufferers of coronary heart disease (4-7).

Hypercholesterolemia and hypertriglyceridemia are regarded as the risk factors in atherosclerosis (8). In the meantime, an increase in serum cholesterol levels in rats fed a high zinc diet, has prompted that zinc may be atherogenic in man (9). Another investigation was performed to examine the effect of oral zinc administration on human lipoprotein values. The sharp fall of the "antiatherogenic" lipoprotein HDL associated with zinc administration supports the concept that zinc ingestion may be atherogenic in man (10) and may increase the coronary artery disease risk (11). According to another group of researchers varying the amount of zinc in the diet did not produce significant changes in plasma total cholesterol, plasma free cholesterol, HDL cholesterol or HDL-apolipoprotein concentration (12). These findings prompted us to study on the total blood cholesterol and HDL-cholesterol and serum zinc levels of patients with cardiovascular diseases.

EXPERIMENTAL

Materials

Eighty-one patients with cardiovascular diseases admitted to the Cardiology Department of Yüksek İhtisas Hospital, were constituted the material for the present study. Twenty-four healthy subjects of matched age and sex were served as controls. The patients with CVD were treated with digitoxine, furasemide and potassium chloride. Healthy volunteers did not receive any drug.

Methods

We determined the total blood cholesterol, HDL-cholesterol, serum zinc level, body mass index of the subjects. We took blood from the superficial arm vein before breakfast in the morning and serum was obtained by centrifugation.

Total blood cholesterol level was assayed by modified Zak Method (13). HDL-cholesterol level was measured on heparin-manganese supernatant by the method of the Lipid Research Clinics (14). Serum zinc level was determined by dilution method with deionized distilled water in Varian-Techtron Model 1200 atomic absorption spectrophotometer (15).

Routine statistical methods were used to calculate the mean and the standard deviation. The mean values for the patients and the control group were compared by student's test (16).

RESULTS AND DISCUSSION

The results obtained from this study are summarized in Table I, Table II and Table III.

The mean total blood cholesterol, HDL-cholesterol, and serum zinc levels of female patients with CVD were found 221.34 ± 13.28 mg/dl, 58.76 ± 3.28 mg/dl and 145.74 ± 10.18 μ g/dl respectively. In control group, the mean values were 158.10 ± 8.19 mg/dl for total blood cholesterol, 46.70 ± 4.67 mg/dl for HDL-cholesterol and 121.60 ± 5.19 μ g/dl for serum zinc level.

The mean total blood cholesterol, HDL-cholesterol, and serum zinc levels of male patients with CVD were found 250.24 ± 12.27 mg/dl, 54.24 ± 1.98 mg/dl, 145.47 ± 6.87 μ g/dl respectively. In control group, the mean values were 140.90 ± 10.76 mg/dl for total blood cholesterol, 36.60 ± 2.65 mg/dl for HDL cholesterol and 106.80 ± 5.48 μ g/dl for serum zinc level.

The total blood cholesterol, HDL-cholesterol and serum zinc level were in normal range both males and females in, control group.

The total blood cholesterol, HDL-cholesterol and serum zinc levels in patients with CVD were significantly higher than the control group. The results are shown in Table III.

It is well known that high density lipoproteins (HDLs) are the major lipoprotein group associated with decreased incidence of the

Table I- The mean values of total blood cholesterol, HDL-cholesterol and serum zinc levels in male and female patients with CVD

| | Number of subjects | Total blood cholesterol (mg / dl) | HDL cholesterol (mg / dl) | Serum zinc level (ug/dl) |
|---------------------------------|--------------------|-----------------------------------|---------------------------|--------------------------|
| Female Mean \pm S.E | 29 | 221.34 \pm 11.28 | 58.76 \pm 3.28 | 145.74 \pm 10.18 |
| Male Mean \pm S.E | 52 | 250.24 \pm 12.27 | 54.24 \pm 1.98 | 145.47 \pm 6.87 |

Table II- The mean values of total blood cholesterol, HDL-cholesterol and serum zinc levels in control groups

| | Number of subjects | Total blood cholesterol (mg / dl) | HDL - cholesterol (mg / dl) | Serum zinc level (ug/dl) |
|----------------------------------|--------------------|-----------------------------------|-----------------------------|--------------------------|
| Female Mean \pm S.E. | 12 | 158.10 \pm 8.19 | 46.70 \pm 4.07 | 121.60 \pm 5.19 |
| Male Mean \pm S.E. | 12 | 140.90 \pm 10.76 | 36.60 \pm 2.65 | 106.80 \pm 5.48 |

Table III- Significant differences; in total blood cholesterol, HDL-cholesterol, serum zinc levels between patients with CVD and control group

| | Patients with CVD Mean \pm S.E. | p | Control Mean \pm S.E |
|----------------------------------|--------------------------------------|-----------|----------------------------|
| Total blood cholesterol (mg /dl) | | | |
| Female | 221.34 \pm 11.28 (29) | p < 0.001 | 158.10 \pm 8.19 (12) |
| Male | 250.24 \pm 12.27 (52) | p < 0.001 | 140.90 \pm 10.76 (12) |
| HDL-cholesterol (mg / dl) | | | |
| Female | 58.76 \pm 3.28 (29) | p < 0.05 | 46.70 \pm 4.67 (12) |
| Male | 54.24 \pm 1.98 (52) | p < 0.001 | 36.60 \pm 2.65 (12) |
| Serum zinc level (ug / dl) | | | |
| Female | 145.74 \pm 10.18 (29) | p < 0.05 | 121.60 \pm 5.19 (12) |
| Male | 145.47 \pm 6.87 (52) | p < 0.001 | 105.80 \pm 5.48 (12) |

* No of studied subjects is shown in parenthesis.

cardiovascular diseases. Therefore, they are considered to be negative risk factors (3). HDL fraction appears to have an inverse relation to the risk of coronary heart diseases. The lower its concentration in the blood, the greater the risk of developing CVD (2). Lipid and lipoprotein studies in the past have generally emphasized the positive relationship of total cholesterol, low density lipoprotein, to the risk of CVD. The results of this study showed that the total blood cholesterol, HDL-cholesterol level of male and female controls were in normal range whereas the total blood cholesterol levels were higher for male and female patients with CVD as compared to controls. These results are in agreement with the other studies which relatively high HDL-cholesterol levels have been observed in CVD (17). According to our results, the male's HDL-cholesterol level was lower than the mean female's HDL cholesterol level in control group. Some researchers observed that the man HDL-cholesterol value was related to sex that women have a substantially higher level than men and incidence of CVD was found to be inversely related to the level of cholesterol bound to HDL-cholesterol fraction (18,19).

A long list of trace elements has been implicated in the pathogenesis of CVD. Cardiovascular diseases are, in general, correlated with the age. The causes of the age effect can be of many kinds, it could

even be an effect of a trace element of which the concentration changes with age.

Pories (20) has reported specific zinc deficiencies associated with CVD especially atherosclerosis. Henzel and others (21) reported that oral administration of zinc sulfate has been beneficial in the treatment of a significant percentage of inoperable and severely symptomatic atherosclerotic patients. However, Filo and others (22) reported that zinc supplementation of an atherogenic diet resulted in the enhancement of aortic atheromatous involvement in an animal model. It has been shown that nutritional zinc increased serum cholesterol level in rats (9). In pharmacologic doses, zinc decreases high density lipoproteins in human (10). A strong negative correlation has been reported between the zinc concentration of the aorta and atherosclerosis of the aorta (9).

The results of the present study show that serum zinc concentrations in CVD were significantly higher than in control group. The rise of serum zinc levels, following CVD, observed in the present study is in conformity with the observations made by other workers (9,10,22,23). These results suggest that there is a relation between zinc level and CVD risk. Significantly high zinc levels in CVD can be both a cause and effect of the atherosclerotic alterations or the result of another unknown parameter.

We can conclude from these results that higher serum zinc and cholesterol levels in patients with CVD go up with higher atherogenic risk. The serum zinc level is another risk factor for CVD and it must be checked with the other factors in diagnosis of CVD.

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