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SERUM β-CAROTENE CONCENTRATIONS IN CHRONIC RENAL FAILURE[1]

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Kronik Böbrek Yetmezliğinde Serum β–Karoten Düzeyleri

SUMMARY

β-carotene is an important antioxidant substances and, it prevents the oxidation of the unsaturated lipids, so quenches the formation of free radicals (FR). FRs have an affectingly role in damage of enzymes, proteins and lipids in cellular membranes and tissues. Low serum concentrations of β-carotene may be a risk factor in the etiology of chronic renal failure (CRF). Therefore, we investigated serum β-carotene concentrations in 36 chronic hemodialysis patients with CRF and 20 healthy controls. Serum ß-carotene concentrations in patients and controls were 108.47 µg/dl and 155.00 µg/dl, respectively. Serum values of this essential substance in the controls were significantly higher ($P<0.005$) than those of the patients. According to these data, low β-carotene levels in serum may play a role in etiology of the CRF.

Key words: Serum β-carotene, chronic renal failure

ÖZET

β-karoten önemli bir antioksidan maddedir ve doymamış yağların oksidasyonunu önleyerek serbest radikallerin (FR) oluşumunu baskılar. Serbest radikaller dokular ve hücresel zarlardaki enzimler, proteinler ve lipitlerin dejenerasyonunda oldukça etkili bir role sahiptir. Serum β-karoten düzeyinin düşük olması kronik böbrek yetmezliği (CRF) etiyolojisinde önemli bir risk faktörü olabilir. Bu yüzden 36 kronik böbrek yetmezliği olan hemodializ hastası ile 20 sağlıklı kontrolde serum β-karoten düzeylerini araştırdık. Hastalar ve kontrollerdeki β-karoten değerleri sırası ile 108.47 ve 155.00 µg/dl olarak saptandı. Bu esansiyel maddenin kontrollerdeki değerleri istatistiksel olarak hastaların değerlerinden daha yüksekti ($P<0.005$). Bu sonuçlara göre serum β-karoten düzeyinin düşük olması kronik böbrek yetmezliği etiyolojisinde önemli bir rol oynayabilir

Anahtar kelimeler: Serum β-karoten, kronik böbrek yetmezliği.

[1] The abstract of this study was presented (as a poster) at National Congress of Association of Turkish Physiological Sciences in Ankara

INTRODUCTION

ß-carotene is known as an important natural antioxidant that is present in mainly fruits and vegetables (1). Although, its antioxidant functions are definitely determined, other physiologic functions and possible different effects have still been investigated (1-3). Serum ß-carotene concentrations in healthy men and women may reflect only intake in recent weeks or months, while its liver and other tissue levels are likely to reflect the longer period of intake of carotenoid-rich diets (1-4). Possible role of ß-carotene deficiency in etiology of disorders in newborn and adults are not clear yet. However, plasma ß-carotene concentration is influenced by dietary intake (1-4), seasonal variation (5), and ages (6). Low plasma concentrations of ß-carotene have been reported to be a risk factor in the etiology of cancer (7), cerebrovascular diseases (8), aging process (9), and chronic renal failure (10). In addition, it has been reported that the decreased production of NADPH due to a defect in pentose phosphate pathway activity, lead to accumulation of free radicals and thus increase the susceptibility of red blood cells to lipid peroxidation in patients with chronic renal failure (11).

Therefore, this study was designed to determine the mean concentrations and ranges of serum ß-carotene in chronic renal failure (CRF) and to investigate whether there is a relation between serum ß-carotene concentrations and CRF.

MATERIALS AND METHODS

In this study, 36 patients with CRF and 20 healthy controls were investigated. At the time of the study, controls were normal, healthy, volunteers. Neither patients group nor controls were received extra ß-carotene or vitamin A (except for ß-carotene in diet) during the investigation. All patients were taken on regular hemodialysis treatment in Hemodialysis Center of Research Hospital at Fırat University.

Blood samples were collected into glass tubes from all patients and controls. For ß-carotene analyses, all blood samples were wait and centrifuged and then their serum was removed. All serum samples were promptly wrapped in aliminium foil to protect against photooxidation of ß-carotene. Harvested serum samples were frozen at -20 ^{o}C. Analysis of the samples under golden-fluorescency light to protect against photooxidation of ß-carotene was completed at 48 hours. ß-carotene concentrations of all the samples were determined spectrophotometrically by the methods of Martinek (12) and Tsen(13).

Statistical Analyses. Means and the standart errors were collected and, paired student "t"-test and individual scattering of ß-carotene were performed on computer using Macintosh Performe-450 by statistical software programme of Feldmann and Gagnon, Brain Power Inc. Calabasas CA(14), and figures were lined by Microsoft Graph Programme, in Microsoft Word TU1-5.1, Microsoft Corp., 1993(15).

RESULTS

Serum concentrations, standart errors and variation ranges of ß-carotene in serum of patients and controls are presented in Table1. Individual distrubition of ß-carotene concentrations in CRF and control groups are shown in Figure 1. ß-carotene concentrations of healthy controls were significantly higher ($P<0.005$) than the values of the patients (Table 1).

Table 1. Serum ß-carotene concentrations and variation ranges

	Serum ß Carotene, µg/dl		
Groups	n	Means ± SE	Ranges
Patients	36	108.47±5.20	55 - 175
Controls	20	155.00±8.76*	105 - 185

*SE is standart errors, *: P<0.005*

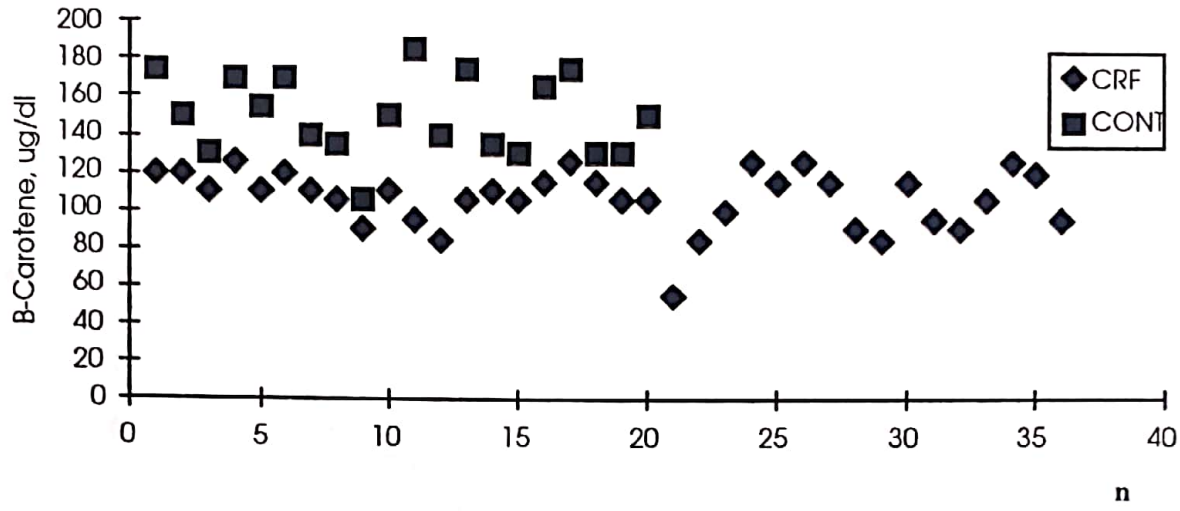

Figure 1. Indivudial values of ß-carotene in patients and controls

DISCUSSION

Free radicals (FR) are molecules and molecular fragments with an unparied electron (3,9). These radicals are produced during normal metabolism and self catalysing autooxidative reactions of lipid peroxidation. Polyunsaturated fatty acid in cell membrane and other tissues are particularly susceptible to free radical-mediated peroxidation leading to damage in structure of cell membrane (3). The accumulation of FR in cellular structures may increase the susceptibility of red blood cells in patients with CRF (11).

In addition, free radicals may play a role in damage of enzymes, proteins, lipids and low density lipoproteins (LDL) in endothelial cells of the artherial wall. Oxidised LDL could be formed toxic effect for endothelial cells and may cause aggregation of thrombocytes and monocytes in endothelial layer of the artherial wall, and thus the progress of artherosclerosis may start in the wall of artherial vessels (14,16,17). On the other hand, it was reported that chronic renal patients undergoing maintenance hemodialysis were known to suffer from increased mortality rate from atherosclerosis. However, it has been noted that the statistics from kidney centers around the world revealed a 50% mortality rate due to cardiovascular diseases in dialysis patients (18).

ß-carotene, like other antioxidants (vitamins C, E and GSH-Px), is one of essential antioxidant the responsible for protection of cellular lipids, the susceptible to peroxidation. This antioxidant substance quenches oxidants and may prevent the formation of FR in cellular membrane and tissues (1,3).

Physiologic ranges of ß-carotene in serum and other tissues are still being investigated (1,4). In the present study, serum ß-carotene concentrations were determined to be significantly lower ($P<0.005$) in chronic hemodialysis patients than in the healthy controls (Table 1). These results are in agreement with the results of different authors who found a relationship between low ß-carotene concentration and the occurance of CRF(10). Unfortunately, the mechanism causing the decrease of serum ß-carotene values in chronic renal failure is still not known. This decrease may be attributed to the excessive lipid peroxidation.

In conclusion, protective treatment could be taken by receiving ß-carotene and other essential antioxidants (vitamins C, E and GSH-Px) to patients in early period of renal failure and so, it may partially prevent the oxidation of LDL. Although these results, there is need for further detailed studies in order to assess the possible relationships between ß-carotene and chronic renal failure.

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