

COMPARISON OF THE PLASMA TRACE ELEMENT LEVELS IN PATIENTS WITH CHRONIC RENAL FAILURE BEFORE AND AFTER HAEMODIALYSIS AND HEALTHY SUBJECTS

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SUMMARY : 22 male and 18 female, total 40 patients with chronic renal failure (CRF) of mean age 42 ± 2 years and 11 female 9 male, total 20 healthy controls of mean age 37 ± 3 years were included into the study. The fasting venous blood samples were taken before and after a haemodialysis session (4 hours) and the levels of zinc (Zn), copper (Cu), magnesium (Mg) were analysed by an Hitachi Z-800 flame atomic absorption spectrophotometer. In patients with CRF, the plasma mean levels ($\mu\text{g/dl}$) of trace elements before and after haemodialysis were for Zn : 68.8 ± 3.2 and 64 ± 2.6 ; Cu : 160 ± 6 and 159.4 ± 7.3 ; Mg : 4.8 ± 0.2 and 2 ± 0.1 . There were no significant differences between the pre and post - haemodialysis mean levels of Zn and Cu ($p > 0.05$); while pre-haemodialysis mean Mg levels were significantly higher than post-haemodialysis levels ($p < 0.01$). The mean levels of Zn, Cu, Mg in healthy subjects were 96 ± 4 , 94.6 ± 5.6 and 3.53 ± 0.2 respectively. The mean levels of Cu and Mg were significantly higher ($p < 0.01$) and Zn was lower ($p < 0.01$) than the mean levels of the control group.

As a results in haemodialysis patients with CRF, the Cu and Mg levels were higher and Zn levels were lower than the healthy controls and a session of haemodialysis therapy decreases Mg levels.

Key Words : Trace Elements, Chronic Renal Failure, Haemodialysis.

INTRODUCTION

The trace elements (Zn, Cu, Mg) act as metallo-enzymes in many chemical reactions of the human body (13, 14, 15). The determination of the changes in plasma trace element levels in patients with CRF might be useful to improve the metabolic disorders. Conflicting data have been published on the change of trace element levels in patients with CRF (2, 6, 7, 8, 9, 10, 12).

The purpose of this study is to investigate the levels of trace elements and to compare the results in healthy subjects and in patients with CRF on haemodialysis therapy before and after a haemodialy-

sis session.

MATERIALS AND METHODS

Forty patients with end-stage CRF (GFR < 5 ml/min) who were on haemodialysis treatment two or three times - 4 hours - weekly and 20 healthy subjects as a control group were studied. The patients were dialysed by cuprophane hollow-fiber dialysers on Gambro AK-10 and Fresenius A 1008 D machines using deionized water and Diasol solution. The fasting venous blood samples were taken in the morning from healthy subjects, and both before and 4 hours later than the end of the haemodialysis session from patients with CRF. The blood samples

were collected in polystyrene tubes with heparin, plasma of the samples were separated and preserved at -20°C until the study day. Plasma levels of Zn, Cu and Mg were measured by Hitachi Z-8000 flame atomic absorption spectrophotometer (12, 16).

The statistical evaluation was performed using Student's t test.

RESULTS

Of the 40 patients 22 (55 %) were male, 18 (45 %) were female and of the 20 control subjects 9 (45 %) were male while 11 (55 %) were female. The mean ages were 42 ± 2 years in the patients and were 37 ± 3 years in the control group; but the difference was not statistically significant ($p > 0.05$). The renal failure etiology of the patients are illustrated in table 1.

Renal Disease	n
Chronic glomerulonephritis	13
Chronic tubulointerstitial nephritis	7
Polycystic disease	2
Secondary amiloidosis	2
Hypertensive nephrosclerosis	2
Unknown	14
Total	40

Table 1 : Renal failure etiology of the patients.

The mean plasma levels of Zn, Cu and Mg in patients before and after haemodialysis and healthy controls are illustrated in table 2.

Element	Patients (n:40)		Controls (n:20)
	Before dialysis I	After dialysis II	
Zn*	68.8±3.2**	64.0±2.6	96.0±4.0
Cu	160.8±6.0	159.4±7.3	94.6±5.6
Mg	4.8±0.2	4.2±0.1	3.5±0.2

* µg/dl

** mean ± standart error

Table 2 : The mean trace element levels of the study groups.

The statistical evaluation of the differences between mean levels of the trace elements are shown in table 3.

The levels of the trace elements in a standart dialysis solution (Diasol) used in our haemodialysis

Element	I/II p	I/III p	II/III p
Zn	> 0.05	< 0.01	< 0.02
Cu	> 0.05	< 0.01	< 0.01
Mg	< 0.05	< 0.01	< 0.01

I : Patients with CRG on haemodialysis before a single dialysis session
 II : Patients with CRG on haemodialysis after a single dialysis session
 III : Control group; healthy subjects.

Table 3 : Statistical evaluation.

unit were measured and following values were obtained; Zn : 0, Cu : 0.5 and Mg : 2.3 µg/dl.

DISCUSSION

Trace element levels, especially Zn and Cu in patients with CRF have already been extensively studied (3, 6, 8, 11, 12). The common finding of these studies was the decreased level of Zn before dialysis session compared to the healthy controls. These reports support our finding of decreased Zn levels in patients with CRF, but the increase in Zn levels after dialysis reported in some studies is in contrast to our findings (3, 6, 12). Zn deficiency in patients with CRF may be due to protein malnutrition, redistribution of Zn in intracellular compartments because of acidosis and increased renal excretion of Zn due to a tubular reabsorption failure (11).

The observation-contrary to our results-of increased Zn levels after a dialysis session in some studies was attributed either to binding of Zn to relatively increased serum proteins due to haemoconcentration or to dialysis fluid, dialysis membrane and other used materials containing zinc oxide. Moreover it is concluded that the use of purified or deionized water might prevent the measurement errors (9, 12, 17).

There are different reports about plasma Cu levels in patients with CRF. Increased, decreased or normal plasma levels of Cu have been reported in chronic renal patients (4, 6, 7). In some studies, low Cu levels were increased after a dialysis session in patients with chronic renal failure (4, 8, 11). It is suggested that Cu levels were decreased in patients with CRF as a result of Cu loss with the high protein excretion and inadequate intake (17). In our study

Cu levels were increased and have not changed after haemodialysis and this finding is supported by two other studies (1, 5).

Mg is an important element of the organism and elevated levels were reported in patients with CRF (7, 11, 12). Our findings are in accordance with these findings. Paydaş et al. found higher levels after dialysis, while the levels of Mg were found to be decreased after dialysis in our study (12). Trace elements are associated with renal osteodystrophy in patients with renal failure. Aluminum and magnesium may also accumulate in bone and be associated with renal osteodystrophy in patients with renal osteodystrophy. The increase in serum magnesium levels is also associated with an increased content of magnesium in bone, a factor that may affect crystal formation (11).

In conclusion, CRF patients on haemodialysis result in hypermagnesaemia, hypercupraemia and zinc depletion. A single hemodialysis session decreases the elevated Mg levels. However, although our findings are supported with some available data, further studies are needed.

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