



Assessment of copper, zinc and lead levels in patients with renal failure before and after their first dialysis

Enas Jabbar Hasan

Zahraa Ismaeel Abudal Kadhum

Science Department, basic education College, University of Al-Mustansiriya,

enasjabbar.edu@uomustansiriyah.edu.iq

Abstract

Dialysis patients are at risk on imbalance (deficiency and a accumulation) of essential trace elements based on diet, decreased kidney function and removal by dialysis. The aim of this study was to estimate the Cu, Zn and lead levels in patients with renal failure before and after their dialysis and healthy group.

Method: this study included fifty chronic renal failure patients (CRF) collected from Al-kindy teaching hospital, Baghdad compared with fifty healthy as a control group. Cu, Zn, Pb concentration were measured by atomic absorption spectrophotometer in serum of CRF patients per and post dialysis and control group. **Result:**The results showed a significant increase at $p \leq 0.05$ in Zn and Pb concentration in serum of pre and post CRF patients compared with control group. While a significant decrease in Cu concentration in serum of CRF patients before and after dialysis compared with control group. **Conclusion:** there was a significant decrease of Cu level in patients (before and after dialysis) compared with healthy group. While the concentration of Zn and Pb were significant increase in patients (before and after dialysis).

Key word: trace elements, renal failure, chronic renal failure, dialysis.

Introduction

Renal failure occur when the waste of metabolism (like nitrogenous waste) accumulate in kidney because the kidney unable to release them ⁽¹⁾. At the same time some renal function (regulation of fluid, some trace elements) may be fail ⁽²⁾. To remove these uremic toxins the patient undergoes hemodialysis ^(3,4), so the patients on hemodialysis are susceptible to increased or decreased concentration of trace elements due to their removal by dialysis or low presence in the dietary intake (such as Superoxide Dismutase, Cytochrome C oxidase, Lysyl- oxidase) ⁽⁴⁾. copper is a component that necessary for many enzymes and hemoglobin synthesis ⁽⁵⁾, Cu is required for metabolism of carbohydrates, incorporated into of catecholamine biosynthesis ⁽⁶⁾, the immum system stimulated by Cu to combat infection ,rebuild damaged tissue as well as copper can neutralize free radicals that can damage the cells ⁽⁷⁾. Zinc is an important trace element is essential for nutrition, required for many enzymes (alkaline phosphatase, thymidine kinase). Zinc is a cofactor of

metaloenzymes and it necessary of lipid, protein, carbohydrates metabolism⁽⁸⁾. Zn mainly found in teeth, prostate, testes, bones, liver and kidney⁽⁹⁾.

Lead is a very toxic metal (by both of eating or inhaling it), the reason for its toxicity is its ability to changing the action of enzymes or imitating other minerals that act as cofactors in enzymatic reaction, lead reacts with the basic minerals Ca, Zn, and Fe⁽¹⁰⁾. Low level of Fe and Ca increase the lead toxicity, so the high levels of both can protected the poisoning of lead, Pb can damage the brain and kidneys⁽¹¹⁾. The aim of the study included estimate the Cu, Zn and lead levels in patients with renal failure before and after their dialysis and healthy group.

Material and method

One hundred samples were collected from Al-Kindy teaching hospital, their age range between 40-50 years, they were classified into (50) patients with chronic renal failure patients (CRF) (pre and post) dialysis (The diet of the dialysis patients was not changed . The dialysis patients received first session, by using alter touch 100 equipment (Darke willowk, Sweden), acetate buffer was used. The blood flow rate was 150-250 ml/min, dialysate flow rate was 500 ml/min.), and (50) as a control group with no previous disease may interfere with parameters in this study.

Ten milliliters of blood was taken from the group , placed into clean plain tube , left for 15 minutes at room temperature, centrifuged at 3000 rpm for 20 minutes , then stored at (-20C) until time of analyzed .

Determination of (Cu, Zn, Pb) serum concentration was analyzed by using atomic absorption spectrophotometer (schimadzu AA- 646) (Japan)

Results and Discussion

Serum copper, zinc and lead concentration of chronic renal failure and control group were shown in table (1) and fig (1)

Table (1): Serum Cu, Zn, Pb concentration of patients and control group.

	No	Cu (μmol/L)	Zn(μmol/L)	Pb(μmol/L)
pre-dialysis	50	24.291±8.598	15.45±6.93	26.73±6.82
post-dialysis	50	21.89±8.625	16.781±7.021	27.58±3.78
control	50	25.42±6.865	11.010±2.986	15.86±6.12

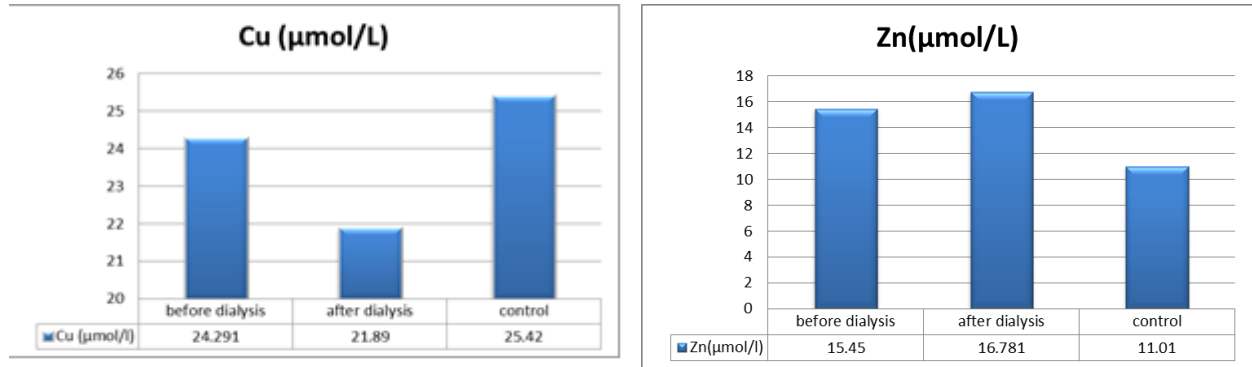


Figure (1): Cu level in patients and control group

Figure (2): Zn level in patients and control group

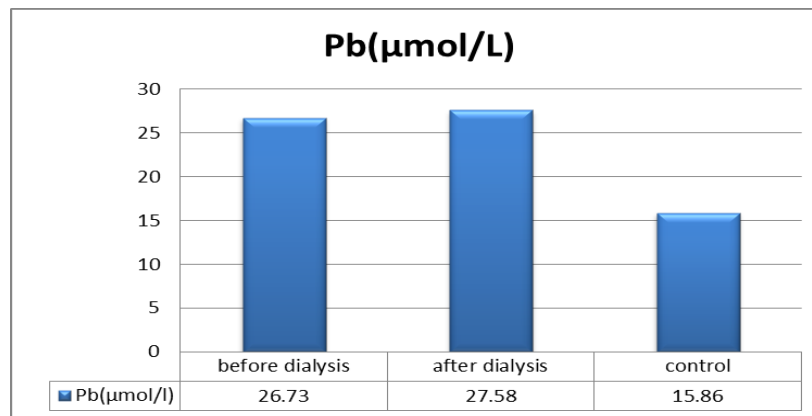


Figure (3): Pb level in patients and control group

The concentration of Zn, Cu and Pb(µmol/l) of renal failure before and after first dialysis were shown in table (1). these table and figure(1) show Cu was significant lower(at $P < 0.05$) in serum of patients (before and after dialysis) compared with normal group, these results was agreement with earlier reported by Heshmatollah,et.al⁽¹²⁾ and Trendafilov.et.al⁽¹³⁾ they showed that serum Cu concentration of dialysis patients were lower than control group. Copper is engaged with many of enzymes is the erythropoiesis, immune system and formation of collagen, Cu is involved in a many metalloenzymes and biological process⁽¹⁴⁾. Excess copper was accumulates in the liver and damaging its metabolic abilities to remove the toxins from the blood. Copper is indispensable for reducing the level of histamine, norepinphrin, and epinephrine, this lead to emergence of psychological imbalances, anxiety and depression⁽¹⁵⁾.

Table (1) and fig (2) showed that Zinc was significant increase (at $P < 0.05$) in serum of patients (before and after dialysis) compared with control groups, this results was agreement with Heshmatollah, et.al (12) and Anusha et.al (16) they found that concentration of Zn was higher in patient than healthy group, while Rui Azevedo et.al (17) were found the level of Zn was decrease in patients than control group, and Almeida et.al (18) impurities in hemodialysis fluids and the incompetency to released them will lead to the precipitation trace element (Zn) in the body of renal failure diseases, there is many conditions that effected to the level of Zinc for example taking medications that containing Zinc, increasing Zinc dietary, contamination water that used in dialysis (19).

Table (1) and fig (3) showed the level of Lead in patients (before and after dialysis) was significant increased (at $P < 0.05$) compared with healthy groups, that result was agreement with many studies (12, 18, and 20). In humans, the highest percentage of Pb is found in bones, and therefore patients with kidney failure suffer from mineral deficiency disorder due to aging, parathyroid hormones, vit.D, PO_4^{-3} , Ca unnatural metabolism and abnormal rebuilding of bone (20, 21).

Conclusion

This study found there was a significant decrease of Cu level in patients (before and after dialysis) compared with healthy group. While the concentration of Zn and Pb were significant increase in patients (before and after dialysis). Further studies are required to investigate the imbalances of trace elements in first dialysis patients

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