EVALUATION OF SERUM ZINC LEVEL BEFORE AND AFTER HEMODIALYSIS IN SUDANESE PATIENTS WITH CHRONIC KIDNEY DISEASE

Abdalroof A.1,2,*, Mohammed T.2 and Hamza E.2,3
1,2,3Department of Chemical Pathology, Faculty of Medical Laboratory Sciences, University of Khartoum –Sudan.

*Corresponding Author: Dr. Abdalroof A. Department of Chemical Pathology, Faculty of Medical Laboratory Sciences, University of Khartoum –Sudan. Mail Id: alaalroof@gmail.com

ABSTRACT
Background: Zinc (Zn) is an essential trace element which plays an important role in growth, cell division, metabolism of protein, carbohydrates, lipids, synthesis of nucleic acid and bone metabolism. Hemodialysis (HD) patient had low serum zinc concentration previously investigated. The present study was aimed to investigate possible affect hemodialysis to decrease zinc concentration by investigating serum zinc levels before and after hemodialysis. Methodology: Serum samples of forty patients on hemodialysis were collected before and after hemodialysis sessions and zinc concentration measure by atomic absorption spectrophotometer. Results: Zinc levels were found decreased by (26%) after hemodialysis when compared to the levels before hemodialysis. Conclusion: Zinc concentrations decrease after hemodialysis due to mechanism of hemodialysis which depends on concentration gradient between blood and dialysis fluid. Zinc supplementation may be recommended in hemodialysis patients with zinc deficiency, also the addition of zinc to dialisat can help to recover the zinc deficiency.

KEYWORDS: Zinc (Zn), Hemodialysis (HD), End stage renal disease, Chronic Kidney Disease (CKD).

INTRODUCTION
Hemodialysis (HD) is one of the major treatments used by end stage renal disease (ESRD) patients. (HD) removes uremic toxins primarily by allowing equilibration of plasma and dialysate across a semipermeable membrane, substances that have lower concentrations in dialysate than in blood tend to be removed by dialysis. This mechanism can decrease urea but also it may lead to depletion of biologically essential substance. Thus hemodialysis patients are at theoretical risk for deficiency of trace elements.1,2

Zinc (Zn) is an important trace element, of which 75–88% found in red blood cells, in the serum it is completely bound to proteins.3 Serum concentrations are dependent on intake and abnormalities are related to malabsorption, liver dysfunction and pancreatic dysfunction. Excessive loss ‘diarrhea’, Increase urinary elimination "diabetes mellitus", Burn, increase demand, hemodialysis4 and alcoholism.5

Some of (Zn) functions are: cofactor for many metal enzymes, necessary for growth and cells’ division especially lymphocytes are sensitive to zinc deficiency,6,5 has multiple roles in metabolism of proteins, complex carbohydrates and lipids, synthesis of nucleic acids, bone metabolism and component of neurotransmitters.6,7 Also Serum Zn levels were found to be associated with some malignancies including head, neck and esophagus cancer.8

Zinc deficient patients become risk for: Anorexia, growth retardation, dermatitis, erosive eczema, skin atrophy, depression/emotional instability, reduced glucose tolerance, night blindness, gonadal hypofunction, increased incidence of ischemic heart disease, delayed wound healing, increased carcinogenesis, susceptibility to infection (compromised immune function) and abnormal pregnancy.3

Alterations of zinc concentrations in serum of dialyzed patients have been previously investigated by Tonelli et al and Sherbeny S S A2,5, the present study was aimed to evaluate the possible alterations of (Zn) by (HD) and evaluate zinc levels before and after hemodialysis.

MATERIALS AND METHODS
Study design: Cross section study. Study area: Selma hemodialysis center. Study group subject: This study involved 40 hemodialysis patients with (CKD) on (HD), among them 20 were female and 20 were male, age range (14-77) year, all patients on (HD) two times a week and each session duration was at least four hours. They were dialyzed with bicarbonate membrane, the duration of dialysis from (2-15) years. patients suffering from other diseases, such as diabetes,
inflammatory diseases, hepatic diseases as well as smokers and alcoholics were excluded from study.

Informed consent was obtained from each participant in the study. The study was cleared by institutional ethical committee. Four ml blood was collected in plain container, both immediately before and after hemodialysis from each patient. The serum was separated within 1 hour after blood withdrawal by centrifugation at 3000 rpm for 10 minutes at room temperature. Serum samples were diluted with deionized water and Zn levels were then measured on atomic absorption spectrophotometer. The concentration of Zn is reported as mg/L after necessary correction was made. The values are expressed as mean ±SD. "ANOVA" test was done for comparison of data.

RESULTS

Table 1: Mean ± SD

<table>
<thead>
<tr>
<th></th>
<th>Result before HD</th>
<th>Result after HD</th>
<th>duration</th>
<th>age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean±SD</td>
<td>0.31±0.08</td>
<td>0.23±0.06</td>
<td>8.8±5.5</td>
<td>45.7±16.3</td>
</tr>
</tbody>
</table>

Table 2: p<0.005 significant, p<0.161, p<0.166, p<0.555 and p<0.092 not significant.

<table>
<thead>
<tr>
<th>Correlation</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Result before / Result after</td>
<td>&lt;0.005</td>
</tr>
<tr>
<td>Result before / Age</td>
<td>&lt;0.161</td>
</tr>
<tr>
<td>Result after / Age</td>
<td>&lt;0.166</td>
</tr>
<tr>
<td>Result before / Duration</td>
<td>&lt;0.555</td>
</tr>
<tr>
<td>Result after / Duration</td>
<td>&lt;0.092</td>
</tr>
</tbody>
</table>

Figure (1): mean of zinc concentration before and after HD.

As shown in figure above (mean ±SD) of zinc concentration mg/L before HD (0.31±0.0845) and mean ±SD of zinc concentration mg/L after HD (0.23±0.0626).

DISCUSSION

Zinc is one of an important trace element which can affect by hemodialysis.

Our result showed in table (2) Serum Zinc levels were highly significantly decreased (P < 0.005) after HD to (26%) as compared to Zinc levels before HD show in figure (1).

Furthermore, we found statistically there were no significant correlations between age and Zinc levels before and after HD (p<0.161) (p<0.166) respectively. Also there were no significant correlations between duration and Zinc levels before and after HD (p<0.0555) (p<0.090) respectively as shown in (Table 2). Before HD all the patients had low serum Zn concentration, regarding the reference range for adult healthy persons (0.5-1.5mg/L). Most authors reported low zinc concentrations in serum of patients undergoing HD my result agree with them, (Bhoad R B et al., 2013) zinc decrease after hemodialysis also agree with (Dvonik S et al,. 2006) which report zinc decrease immediately after hemodialysis and (Neto L C et al,.2016).[1,4,6]

The different concentration between blood and dialysate can affect because principle of dialysis depend on different gradient of concentration between blood and dialisate because of that zinc concentration decrease after hemodialysis.
In recent years, hemodialysis has been successful in extending the life span of renal failure patients. But also (HD) impaired to prevent decrease of an essentials substance like zinc to decrease during dialysis, leading to deficiency in the body which is being increasingly recognized as essential mediators of the development and progression of kidney disease. In the case of zinc supplementation, plasma zinc levels were not change after hemodialysis. That can open chance for treated hemodialysis patient who suffering for zinc deficiency by supplementation.

CONCLUSION
Zinc concentration highly significant decreased after hemodialysis (26%) but not correlated with patient age and duration of dialysis. Future studies has to address zinc after supplementation by different concentration to prevent toxicity.

And the addition of zinc to dialisate also can help to solve this problem.

ACKNOWLEDGMENT
We are extremely thank full to Doctors in Selma Hemodialysis Center, patients have been involved in this research and all the lecturers in Chemical Pathology, Faculty of Medical Laboratory science for their guidance.

REFERENCES
2. Tonelli et al; Trace elements in hemodialysis patients, BMC medicine, 2009; 7: 25.