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Evaluation of plasma zinc and copper in patient with chronic renal failure in Khartoum State - Sudan

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ABSTRACT

The kidney is complex vital organs, and has many functions. The main function it's removal of toxic and excess substancesfrom the plasma, if there is any defect in the kidney like renal failure can disrupt this function. The aim of this study was to determine the level of Zinc and Copper in Sudanese patient with chronic renal failure. This study was designed as case control, which includes 100 blood samples, a 60 from these sample were collected from patient with chronic renal failure and 40 samples were collected from health individual as control group and the sample is collected by using sterile disposable syringes and separated by centrifuge. Carried out in Ribat University Hospital in Khartoum state, during period from March to June 2018. And the plasma levels of zinc and copper determined by the use of atomic absorption spectrophotometer (OPERATOR'S MANUAL January 2003 VER 3.94 C), and the obtained results were analyzed by SPSS. The result of this study showed that there was significant decrease ($p<0.05$) in the plasma levels of zinc and copper in patient with chronic renal failure compared to the control subjects. The mean of plasma Zn was 0.3mg/l in test group and 0.7mg/l in control group with p. value of 0.002 and the mean of plasma Copper was 0.5mg/l in test group and 0.7mg/l in control group with p. value of 0.019. Also the study showed the gender and age of the patient, also the duration of the disease have no effect on the plasma level of zinc and copper ($p>0.05$). The study concludes that the plasma level of zinc and copper are low in patient with chronic renal failure. And the gender and age of the patient also the duration of disease have no significant effect on the plasma level of zinc and copper.

Keywords: Chronic Renal Failure, Zinc, Copper, Sudanese

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INTRODUCTION

The kidneys are vital organs that perform a variety of important functions. The most prominent functions are removal of unwanted substances from plasma (both waste and surplus), homeostasis (maintenance of equilibrium) of the body's water, electrolyte and acid base status, and participation in hormonal regulation. [1]

The renal failure may be acute or chronic, acute renal failure is a sudden, sharp decline in renal function as a result of an acute toxic or hypoxic insult to the kidneys, defined as occurring when the GFR is reduced to less than 10 mL/minute. This syndrome is subdivided into three types, depending on the location of the precipitating defect. And chronic kidney disease (CKD) is a clinical syndrome that occurs when there is a gradual decline in renal function over time. According to the 2007 U.S. Renal Data System (USRDS) Annual Data Report, one in nine U.S. adults have CKD and 20 million more are at risk. [2] Early detection and treatment are needed to prevent progression to ESRD and complications such as coronary vascular disease. The National Kidney Foundation has formulated guidelines for earlier diagnosis, treatment, and prevention of further disease progression. GFR and evidence of kidney damage based on measurement of proteinuria or other markers form the basis of the classifications. [3] The conditions that can precipitate acute renal failure also may lead to chronic renal failure. [4,5]

The essential trace elements are usually associated with an enzyme (metalloenzyme) or another protein (metalloprotein) as an essential component or cofactor. Deficiencies typically impair one or more biochemical functions and excess concentrations are associated with at least some degree of toxicity. [1] Although trace elements, such as iron, copper, and zinc, are found in mg/L concentrations. An element is considered essential if a deficiency impairs a biochemical or functional process and replacement of the element corrects this impairment. Decreased intake, impaired absorption, increased

excretion, and genetic abnormalities are examples of conditions that could result in deficiency of trace elements. The cells of the proximal renal tubule have an important role in the homeostasis of essential metals, and the kidney is a target site for metal toxicity. [6] For this reason, and because of their close chemical similarity and extensive biological interaction, they are often considered together. [7]

MATERIAL AND METHODS

This study was designed as a comparative analytical study, specifically it is case control study, and this study was conducted in Khartoum state, in Ribat University hospital. This study was carried out during the period from March 2018 to June 2018.This study was included one hundred blood samples. 60 of these samples were collected from Sudanese patient with chronic renal failure for different duration, age and including both males and females and 40 samples were collected from apparently healthy Sudanese individuals as control group. All volunteers was enrolled after being fully informed by the aim study, more over an informed consent was taken from every volunteer. A total of 60 blood samples from patient with renal failure the males were 38 with 63% while the rests 22 were females with 37%, the age of population studied ranged between 17–90 years. Two and half ml of venous blood were collected by using sterile disposable syringes and poured into lithium heparin containers, immediately centrifuged and plasma was separated. And the plasma levels of zinc and copper determined by the use of atomic absorption spectrophotometer (OPERATOR'S MANUAL January 2003 VER 3.94 C)

Ethical Consideration

Ethical approval was obtained from ethical committee of Shendi University and Informed consent will be taken from all the participants prior to their inclusion in the study. All the procedures will inform to the patients in their native language and informed written consent will be taken from them.

Sampling Procedure

Two and half ml of venous blood were collected by using sterile disposable syringes and poured into lithium heparin containers, immediately centrifuged and plasma was separated.

Quality Control

The precision and accuracy of all methods use in this study were checked at each batch using commercially prepared control sera.

Statistical analysis

Collected data were computed and analyzed by using the application of SPSS (statistical package for social sciences) version 21. The test used is a T test.

RESULTS

Table 1: Comparison between the means of plasma Zinc in control group and in case group

Study group	Number	Mean (mg/L)	Std. Deviation	P. value
Case	60	0.3	0.17	
Control	40	0.7	0.14	0.002

Table 2: Comparison between the means of plasma Copper in control group and in case group

Study group	Number	Mean (mg/L)	Std. Deviation	P. value
Case	60	0.5	0.30	
Control	40	0.7	0.13	0.019

Table 3: Comparison between the means of plasma Zinc and Copper in patient with age less than 40 years and in patient with age more than 40 years

Element trace	Age						P. value
	Less than 40 years			More than 40 years			
	No	Mean (mg/L)	Std. Deviation	No	Mean (mg/L)	Std. Deviation	
Copper	19	0.5	0.28	41	0.5	0.31	0.527
Zinc	19	0.2	0.16	41	0.3	0.18	0.434

Table 4: Comparison between the means of plasma Zinc and Copper in male and in female patient

Element trace	Gender						P. value
	Male			Female			
	No	Mean (mg/L)	Std. Deviation	No	Mean (mg/L)	Std. Deviation	
Copper	38	0.4	0.29	22	0.6	0.30	0.667
Zinc	38	0.3	0.18	22	0.3	0.16	0.578

Table 5: Comparison between the means of plasma Zinc and Copper in patient having a disease less than 6 years and patient having a disease more than 6 years

Element trace	Duration of disease						P. value
	Less than 6 years			More than 6 years			
	No	Mean (mg/L)	Std. Deviation	No	Mean (mg/L)	Std. Deviation	
Copper	41	0.5	0.30	19	0.4	0.28	0.621
Zinc	41	0.3	0.18	19	0.2	0.15	0.692

DISCUSSION

The present study was carried out to investigate trace element (zinc and copper) among chronic renal failure patients in Ribat University Hospital, during the period from March to June 2018; 100 blood samples were collected, a 60 of these samples were collected from patient with renal failure as test group, and 40 samples were collected from health individual as control group.

The present study showed statically significant difference between the mean of the plasma levels of zinc and copper of the test group when compared with that of the control group, both are decreased. That illustrated in tables 4.1 and 4.2. This agrees with (G. Murugan 2007) who was reported statically significant changes in the zinc metabolism. This was evidenced by statistically significant decrease in serum zinc levels in the study group suggesting zinc deficiency. Also similar study cared in India by (Z. Ghoreshi, S.K. Ahaley, et al, 2011) agree with serum zinc level, who report significant decreased in serum zinc level and disagree with serum copper level, who+ report no significant effect on serum copper level. [8, 9]

The results of this study showed insignificant difference between the plasma levels of zinc and copper of the test group according to the age. That illustrated in table 4.3. And also according to the gender. That illustrated in table 4.4. This agree with (G. Murugan 2007) who was reported statically no significant influence of age and sex on zinc levels when compare of serum zinc status between age and sex of study group. [8]

Also the results of this study showed that there was insignificant difference between the plasma levels of zinc and copper of the test group according to the duration of disease with. That illustrated in table 4.5.

CONCLUSION

The plasma level of zinc and copper was affected by the renal failure, the plasma level of zinc and copper are low in patient with renal failure. And the age and gender of the patient have no significant effect on the plasma level of zinc and copper also the duration of the disease have no effect.

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