Assessment of The Levels of Serum Zinc and Copper Among Sudanese Patients with Sickle Cell Anemia in Khartoum State

Abstract:

Background: Sickle cell anemia (SCA) is associated with increased risks of multiple micronutrient deficiencies, zinc deficiency has been observed in patients with Sickle cell anemia, due to chronic hemolysis with subsequent loss of zinc from RBCs.

Objectives: The aim of this study was to assess the level of zinc and copper among Sudanese Patients with sickle cell anemia (SCA).

Methods: Across sectional study was conducted during the period from March to April 2018, fourty samples from diagnosed patients with sickle cell anemia (SCA), admitted to

Albuluk hospital in Khartoum state as cases and fourty samples from healthy individual

With normal hemoglobin as controls, the level of zinc and copper was measured by using atomic absorption spectrophotometer, Data analysis was carried out by SPSS version 21.

Results: There were a significant decreased in the levels of zinc and copper in patients with sickle cell anemia (SCA) with p-value = (0.000) (0.000) respectively, when compared to healthy individuals. The (Mean ±SD; 0.137±0.079 versus0.705±0.138ng/L) (0.512±0.290 versus 0.923±0.214ng/l) respectively. Also there was insignificant variation in the levels of zinc and copper in male patients compared to female patients, p-value (0.345) (0.656) respectively. The (Mean ±SD; 0.144±0.079 versus0.127±0.080 ng/L) (0.502±0.271ng/L versus 0.525±0.321 ng/L) in respectively, also there was negative correlation between levels of (zinc and copper) with duration time of disease, with (R= -0.603, p-value= 0.000) and (R= -0.443 p-value= 0.004) respectively, But there was no correlation between levels of (zinc and copper) with ages.

In Conclusion: the levels of zinc and copper were decreased in patients with sickle cell anemia when compared to healthy individuals, and also there was negative correlation between the levels of (zinc and copper) and duration time of disease.

KEYWORDS: Sickle cell anemia, zinc, copper, micronutrient and Sudanese.

Introduction:

Sickle cells anemia (SCA) is a hemoglobinopathy characterized by chronic hemolysis,

Chronic inflammation, immune deficiency, a heterogeneous Clinical picture and organ

Damage.[1] SCA is associated with increased risks of multiple micro nutrient deficiencies These deficiencies may have a significant impact on SCA severity indices including growth retardation; cell-mediated immune dysfunction, and cognitive impairment with a negative impact on morbidity and mortality.[2] In addition, these nutriments have a major role in the protection of the red cell membrane against stress and free radical mediated by oxidation in SCA.[3] Sickle cell disease (SCD) is common especially in Africa and among Negroid race. In sickle cell disease; the deficiencies of essential elements some of which are vital in red cell maintenance, body growth and development have been observed.[4] The sickle hemoglobin is known to interact with diverse gene and environmental factors producing a multisystemic disease with several phenotypes. [5]

Minerals are inorganic substances, with chemical constituent present in all body tissues and fluids and they are necessary for the maintenance of certain physicochemical processes which are essential to life.[6,7] They are important for human,[8,9] so deficiencies or disturbances in the nutrition can cause a variety of diseases and can arise in several ways.[10] Nutrient metals from diet are incorporated into blood if blood levels are depleted, transported into cells if cellular levels are inadequate, or excreted if blood and cell levels are sufficient or overloaded. When this system fails to function properly, abnormal levels and ratios of trace metals can develop. One of the most common trace-metal imbalances is elevated copper and depressed zinc; however the aim of this study was to assess the level of serum zinc and copper among Sudanese patients with sickle cell anemia.

Materials and methods:

- **Study design:** this was a Cross sectional case control study.

-**Study area and period:** Blood samples were collected from Albuluk hospital, in Khartoum state, during the period from March to April 2018.

- **Study population:** forty Patients with sickle cell anemia (SCA) as a case and forty sample from normal individual with normal hemoglobin as control, gender and ages was matched (case group with age mean$\pm$SD (6.67$\pm$4.16) years and control group with age mean$\pm$SD 6.37$\pm$4.16 years, sickle cell anemic patients were 43% females and 57% males, and normal healthy individual (control) were 40% female and 60% male.

-**Inclusion criteria:** patients with sickle cell anemia (SCA), were included

-**Exclusion criteria:** any patients take long term zinc supplements and

patients with other chronic diseases (liver disease, renal disease and heart diseases), were excluded.

- **Ethical consideration:** The study was approved by ethical committee of Medical Laboratory Science, Clinical Chemistry Department –Alneelain University. Subjects involved in this study were informed by the aims of the study and its importance, and verbal informed consent was obtained from each participant.

-**Data collection:** by using questionnaire.

- **Sampling:** blood samples were collected and serum was separated.

-**Method:** The levels of serum zinc and copper was measured by using atomic absorption spectrophotometer.

- **Quality Control:** Pathological and Normal control sera were measured, to assure accuracy and precision of results.

-**Data analysis:** Data was analyzed using SPSS version 21.The results were expressed as percentage, Mean and SD. Independent T-test was obtained to compare the study parameters in case versus control group. Correlation was done to study the relationship between study parameters and study variables, p-value less than 0.05 considered significant.

Results:

Statistical analysis showed a significant decrease in the levels of zinc and copper among patients with sickle cell anemia (SCA), when compared to healthy individuals (table1), also statistical analysis showed insignificant variation in the levels of zinc and copper among patients with sickle cell anemia when compared according to gender (table2), also statistical analysis showed negative correlation between the levels of (zinc and copper) and duration time of disease (SCA), (figure1 and figure 2) respectively, and also statistical analysis showed no correlation between the level of zinc and copper with ages among patients with sickle cell anemia, (figure 3 and figure 4) respectively.

Table (1): Comparison the levels of zinc and copper in case versus control:

Parameters	Case (Mean±SD)	Control (Mean±SD)	*P-value*
Copper	0.512±0.290	0.923±0.214	0.000
Zinc	0.137±0.079	0.705±0.138	0.000

P-value less than 0.05 consider as significant

Table (2): Comparison the levels of copper and zinc in case group according to gender.

Parameters	Male (Mean±SD)	Female (Mean±SD)	*P-value*
Copper	0.502±0.271	0.525±0.321	0.656
Zinc	0.144±0.079	0.127±0.080	0.345

P-value less than 0.05 consider as significant

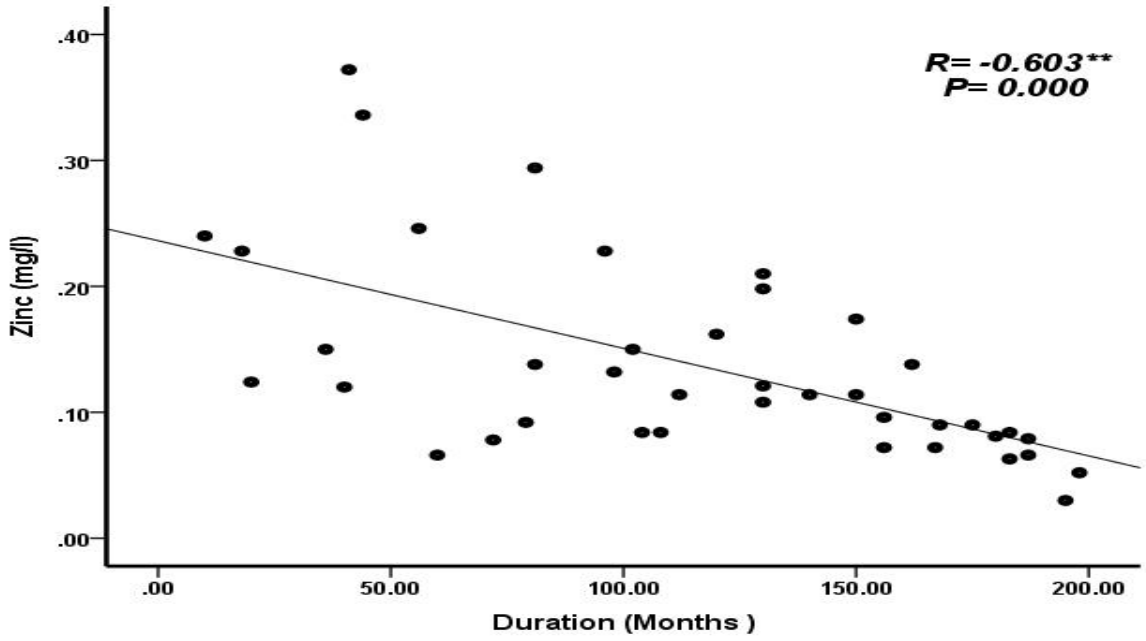
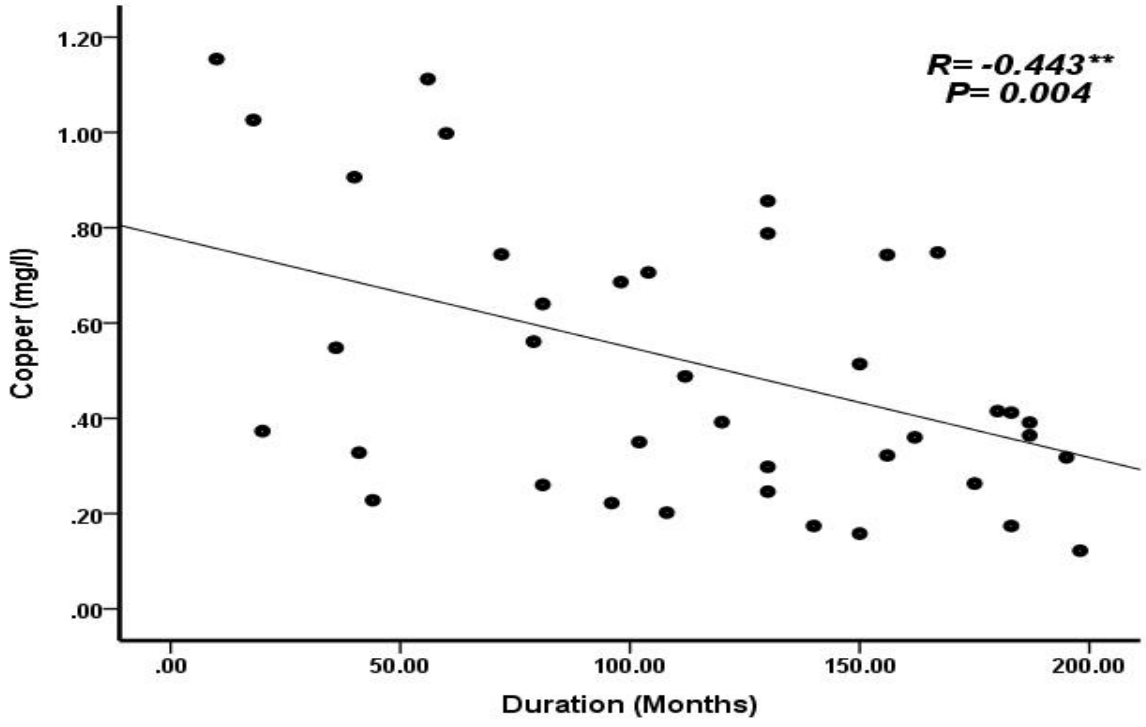


Figure (1): Correlation between the levels of zinc and duration time of disease.

P-value less than 0.05 consider as significant



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117 Figure (2): Correlation between duration time of disease and copper levels.

118 P-value less than 0.05 consider as significant:

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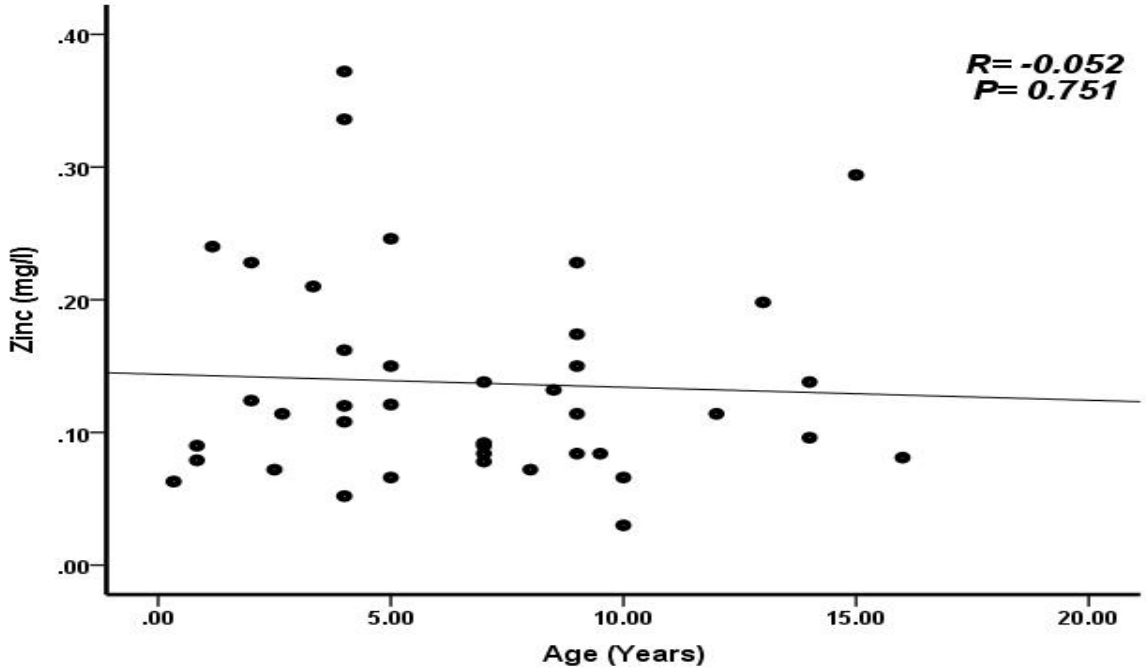

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122 Figure (3): Correlation between zinc levels and ages.

123 P-value less than 0.05 consider as significant:

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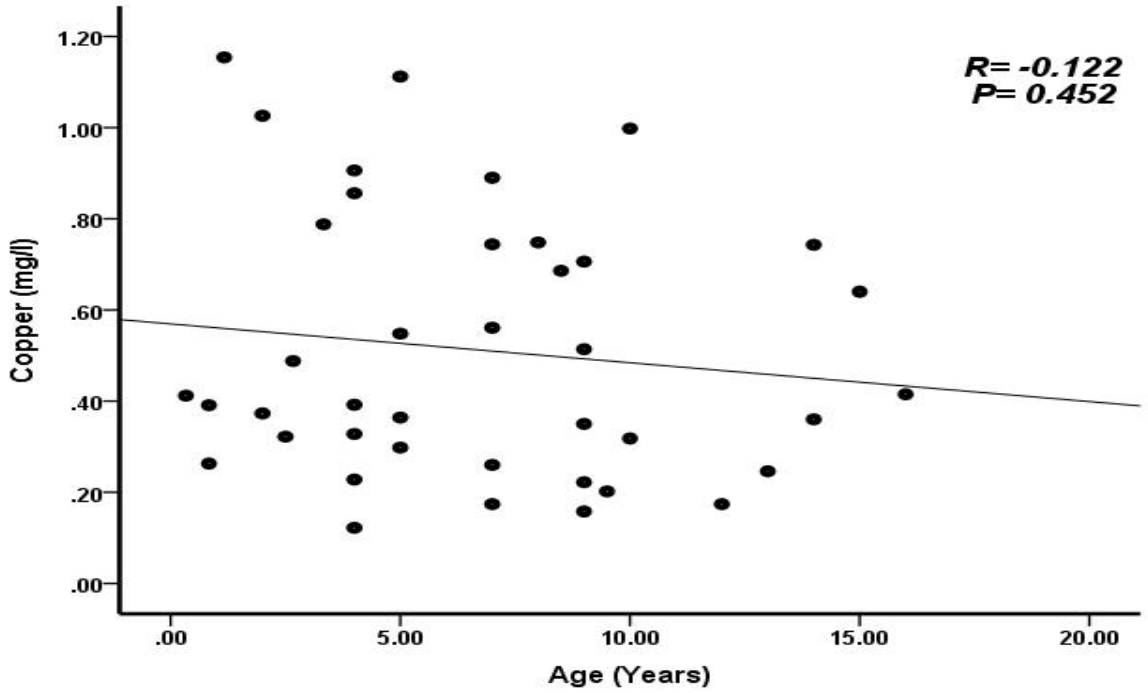

Figure (4): Correlation between copper levels and ages.

P-value less than 0.05 consider as significant:

Discussion:

Sickle cell disease (SCD) is common especially in Africa and among Negroid race, In sickle cell disease, the deficiencies of essential elements some of which are vital in red cell maintenance, body growth and development have been observed, in the current study the levels of zinc and copper showed a significant decrease in patients with sickle cell anemia (SCA) when compared to healthy individuals with p-value (0.000), that might be occur due to chronic hemolysis with subsequent loss of zinc from RBCs, Zinc deficiency can also be the result of the adverse effect of hydrourea which increase zinc excretion.[11] This finding was agreement with results of previous study done by (tagney and Philips, 1993; Parad, 2002; Idonij et al., 2011), which related zinc deficiency in sickle cell disease to manifestations such as growth retardation, hypogonadism in males, hyperammonemia, abnormal dark adaptation and cell mediated immune disorder. Similarly, the biochemical evidence for zinc deficiency in patients with SCD includes low zinc concentrations in plasma, erythrocytes, hair lymphocytes and granulocytes,[12] also there was insignificant variation in the levels of zinc and copper in patients with sickle cell anemia when compared according to gender the p-value was (0.345 and 0.656) respectively, and also there was negative correlation between levels of (zinc and copper) with duration time of disease, with (R= -0.603, p-value= 0.000) and (R= -0.443 p-

value= 0.004) respectively, But there was no correlation between levels of (zinc and copper) with ages.

Conclusions:

The levels of zinc and copper were decreased in patients with sickle cell anemia when compared to healthy individuals, and also there was negative correlation between the levels of (zinc and copper) and duration time of disease.

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