INTRODUCTION
Sickle cell anemia is the most common monogenic inherited autosomal recessive disease in the world, it is a hemoglobinopathy caused by a mutation at position 6 in the beta-globin chain (substitution of valine for glutamic acid in the sixth position of the globin chain) that give rise to production of abnormal hemoglobin molecule called hemoglobin S (Hb S). Protein in red blood cells that carry oxygen to the tissues of the body, sickle cell interferes with the delivery of oxygen to the tissues. The human body has an elaborate system for managing and regulating the amount of key trace metals circulating in blood and stored in cells. Nutrient metals from our 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 zinc and copper. Zinc is essential trace element for human and it plays an important role in several metabolic pathways. There are 2-4 grams of Zn\textsuperscript{2+} distributed throughout the human body. Most zinc is in the brain, muscle, bones, kidney and liver, with the highest concentrations in the prostate and parts of the eye, semen is particularly rich in zinc, which is a key factor in prostate gland function and reproductive organ grow. It is the second most abundant transition metal in organisms after iron and it is the only metal which appears in all enzyme classes. Copper is an essential trace element that is vital to the health of all living things (humans, plants, animals and microorganisms). Copper plays an important role in our metabolism, largely because it allows many critical enzymes to function properly. Copper is essential for maintaining the strength of the skin, blood vessels, epithelial and connective tissue throughout the body. Cu plays a role in the production of hemoglobin, myelin, melanin and it also keeps thyroid gland functioning normally. Copper is essential for the normal growth and development of human fetuses, infants, and children. The human fetus accumulates copper rapidly in its liver.
during the third trimester of pregnancy. At birth, a healthy infant has four times the concentration of copper than a full-grown adult. Human milk is relatively low in copper, and the neonate's liver stores falls rapidly after birth, supplying copper to the fast-growing body during the breast feeding period. These supplies are necessary to carry out such metabolic functions as cellular respiration, melanin pigment and connective tissue synthesis, iron metabolism, free radical defense, gene expression, and the normal functioning of the heart and immune systems.\[^5\]

**MATERIALS AND METHODS**

This is Quantitative descriptive, cross sectional and hospital based study conducted in Sudan Sickle Cell Anemia Center in North Kordofan State, during the period from April to August 2016. A thirty children diagnosis with SCA, enrolled as test group, in comparison to twenty apparently healthy children selected as control group match for age and sex to test group. Blood samples (3ml) were collected by vein puncture from each subject into a plain container. The labeled samples were carefully retrieved and spun in a bucket centrifuge at a speed of 2500 rpm for 30 minutes having allowed the samples to clot for 15 minutes. The serum obtained was stored in a chest freezer at a temperature of -20°Cin vials. Serum trace elements (Copper and Zinc) levels were measured using atomic absorption spectrophotometry technique. All data was recorded in standard sheet then analyzed using the social packages for statistical studies (SPSS v15.) t-test was used for comparison of means and P.value ≤ 0.05 considered statistically significant. The precision and accuracy of the method was used and checked in this study using commercially prepared controls.

**RESULTS**

**Figures 1** Shows the gender distribution among children with Sickle cells anemia patients. The prevalence of sickle cell is more in female than male with percentage 54% and 64%.respectively.

**Table 1** Frequency & percentage of the study groups.

<table>
<thead>
<tr>
<th>Participants</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>Cases</td>
<td>30</td>
<td>60</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>100</td>
</tr>
</tbody>
</table>

**Table 2**: Comparison of the mean ages (months) of test group and control group enrolled in the study.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Test group n=30</th>
<th>Control group n=20</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (months) Range</td>
<td>20.4±10.3 (5-40)</td>
<td>21.8±10.2 (8-40)</td>
<td>0.84</td>
</tr>
</tbody>
</table>

- The table shows the mean ± SD, range in brackets () and probability (P.value).
- t-test was used for comparison.
- P. value ≤ 0.05 is considered significant.

**Table 3**: Comparison of mean of the zinc and copper levels in the test and control groups.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Test group n = 30</th>
<th>Control group n = 20</th>
<th>P.value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zinc (mg/l) Range</td>
<td>0.197 ± 0.07 (0.07 - 0.34)</td>
<td>0.66±0.06 (0.54- 0.85)</td>
<td>0.03</td>
</tr>
<tr>
<td>Copper (mg/l) Range</td>
<td>0.29 ± 0.10 (0.20 - 0.48)</td>
<td>0.74 ± 0.4 (0.70 – 0.87)</td>
<td>0.05</td>
</tr>
</tbody>
</table>

- The table shows the mean ± SD, range in brackets () and probability (P.value).
- t-test was used for comparison.
- P. value ≤ 0.05 is considered significant.
Table 4: Comparison of the means of the serum zinc and copper levels in males and females suffering from Sickle cells anemia.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Male n =14</th>
<th>Female n= 16</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zinc (mg/l)</td>
<td>0.18 ± 0.60</td>
<td>0.21 ± 0.08</td>
<td>0.52</td>
</tr>
<tr>
<td>Copper (mg/l)</td>
<td>0.30 ± 0.72</td>
<td>0.29 ± 0.06</td>
<td>0.60</td>
</tr>
</tbody>
</table>

- The table shows the mean ± SD, range in brackets (), and probability (P.value).
- t– test was used for comparison.
- P. value ≤ 0.05 is considered significant.

DISCUSSION

Sickle cell anemia is a hereditary disorder characterized by formation of abnormal hemoglobin due to mutation in B- globin chain. Trace element (zinc and copper) are essential in the body which is found in minute concentration, but there deficiency can be deleterious because they are important components of enzyme system, and important metabolic pathways.[6]

In the current study there are significant difference between the means of the serum levels of zinc and copper in test group when compare with that of the control group, the means in both were significantly reduced (P. values = 0.03, 0.05) respectively and this may be due to massive urinary excretion occurred as a result of impaired kidney function and also may be because of disturbance of zinc and copper metabolism. Zinc and copper were antagonized in their metabolism but trace elements supplementation may interfere the absorbance of each other. This result agree with previous study[7,8,9] whose report that zinc levels were significantly decrease in SCA and disagree with them regarding copper levels which were significantly increase in their study. Also in the present study there are insignificant difference between the serum zinc and copper levels in male and female among children suffering from sickle cell anemia P. value = 0.52 and 0.60 respectively.

CONCLUSIONS

Finally this study it was concluded that; the serum trace element (zinc & copper) were significantly reduced among the children with sickle cell anemia in North Kordofan State. This reduction may be due to in adequate intake of zinc and copper despite of their normal diet content may be attributable to loss of appetite, chronic pain and hemolysis beside the excessive urinary excretion occurred as a result of renal insufficiency.

Recommendations

1. Reduction of zinc and copper levels need for special attention among children with SCA.

2. Regular supplementation with trace elements with proper monitoring for children with sickle cell anemia.

3. Further trace elements study among children with sickle cell anemia is required.

REFERENCES

8. 29- Pellegrini J, Kerbauy J, Fisberg M. Department of Pediatric, Federal University of Sao Paulo, E scola Paulista de Medicina, Brazil, 1995: 198- 203.