Short communication

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Serum Copper Concentration in Malarial Patients by Atomic Absorption Spectroscopy

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Abstract: Malaria is one of the most serious tropical diseases in the world and has been a health risk to humans for many generations. It is very widespread disease, covering many areas of Europe, North America, South America, Asia and Africa. It is also a major public health problem in Pakistan. Copper, is a trace metal that can generate oxygen radicals by the Fenton's reaction. The Plasmodium parasite invades an erythrocyte host cell containing copper. In the present study, copper level was determined in the blood serum of Malarial Patients (n=12) with comparison to normal subjects (n=12). Metal copper was determined using Atomic Absorption Spectroscopy (AAS, Model Varian A-20) The blood serum level of Copper determined to be 2.6917 ppm, was higher as compared to the 2.045 ppm in normal subjects ($p<0.001$).

Keywords: - Malaria, Copper, Atomic Absorption Spectrometry (AAS).

1. INTRODUCTION

Malaria is a parasitic life threatening disease and a major public health problem in Sub-Saharan Africa and Asia including Pakistan. The risk factors such as unhygienic conditions conducive for the growth of mosquito and poor diet habit leading to weaker immune defense system. There are more then 350-500 Million cases of clinical malaria occur annually, 60% of which are in sub-Saharan Africa. Moreover, 80% of all deaths attributed to malaria occur in this state. In records, 1 million Africans die of the disease each year, with the vast majority of deaths occurring among children below five years of age (*Malaria Facts, Snow RW, et al, 2005, and.http://ftp.iza.org/dp2997, 2008)*. Copper is significant components of several enzymes and metalloproteins, which are involved, in many metabolic processes in the body *(Gupta SK, et al, 1994.)* Copper is an essential nutrient which is generally distributed in food and water and a component of many metalloenzymes that are required for oxidative metabolism, including cytochrome oxidases, ferroxidases, amino oxidases, super oxido dismutase, ascorbic acid oxidase and tyrosinase. Changes in blood zinc and copper have been found in lymphoproliferative disorders, *(Cohen Y, et al 1984 and Andrews GS, et al, 1979)* as well as in breast, lung and gastrointestinal tumors *(Gupta SK, et al, 1991).* In the present study Atomic Absorption Spectroscopy (Varian Model, A-20) is utilized to quantity copper of the blood serum in malarial patients with healthy control.

2. MATERIAL AND METHOD

The metal copper in the blood serum was determined by using Atomic Absorption Spectrometry (AAS) (Model, A-20 Varian). The concentration of the Copper was determined by air-acetylene flame. The standard from 1 to 5 ppm were run on the spectrometer and the calibration curves were obtained prior to running the samples for the determination of copper in the blood serum of normal subjects and the malarial patients. Blood samples were collected from twelve healthy controls in fasting conditions and a similar condition was maintained while taking blood samples of confirmed malarial patients. Each blood sample was centrifuged at 5000 rpm for 20 min. The supernatant of blood serum was used for the analysis of metals copper using Atomic Absorption Spectrometer inserting appropriate hollow cathode lamp in it. All standards used were of analytical grade.

Chemicals and reagents

Sulphosalicylic acid was obtained from Merck, Darmstadt, Germany and Copper chloride to prepare standards were purchased from Sigma Chemical Company. All chemicals were of analytical grade.

Stock Solutions and working Metal standards

Commercial trace metal (**Cu**) atomic absorption standard solution (1000 µg/mL, Sigma Co.) was used. Working standards were prepared from the stock standard solution by diluting with deionized water with addition of few drops of corresponding concentrated acid solution.

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Atomic Absorption Concentration Ranges

Metal	Detection Limit (mg/L)	Sensitivity (mg/L)	Furnace Procedure Detection Limit (mg/L)
Copper	0.02	0.1	1

3. RESULTS

Serum copper concentration in malarial patients and in normal subjects determined to be 2.6917±1.30 ppm and 2.045 ±0.62 respectively. Serum copper was found statistically highly significant in patients with malarial patients compared with those of normal subjects (*P < 0.001).*

Table:1. Serum Copper concentration in malarial patients. All values are expressed as mean SEM.

Malarial Patients	No: of Samples	Mean	Std error Mean	Standard deviation
Age	12	57.5	2.08	7.22
Copper	12	2.69	0.37	1.30

Table:2. Serum Copper concentration in healthy controls. All values are expressed as mean SEM.

Normal Subjects	No: of Samples	Mean	Std error Mean	Standard deviation
Age	12	50.50	1.861	6.44
Copper	12	2.04	0.18	0.62

p<0.001.

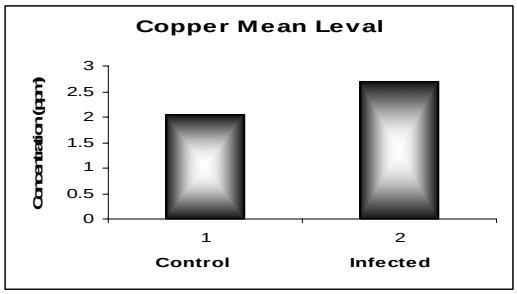

Fig. 1. Serum copper concentration in malarial patients compared with those of normal subjects.

4. DISCUSSION

Fig. 1 (a) shows **Copper** mean value characterized as elevated trace metal during the infection of malaria. Copper is found in a variety of enzymes, the third most abundant trace metal in the human body (*Baloch et al,* 2011). The Metals, zinc and copper, compete for absorption in the digestive tract in a situation where, a diet containing excessive in one of these metals may result in a deficiency in the other *(Majumdar et al, 2003).* It is reported that the copper (Cu) plasma levels were significantly higher in *vivax* malarial patients as compared to those in normal subjects *(Adnan Seyrek et al, 2005).*

However, in the present study the copper (Cu) serum levels significantly was higher in malarial patients as compared to those in healthy subjects. The increase level of copper may results of oxidative stress because the body attempts to store more copper in response to the illness, or whether the high levels of copper are the result of the mental illness. Wilson's disease is developed with the increase level of copper in patients with malaria if not treated properly well in time.

5. CONCLUSION

In this study, we have shown increased serum copper concentration in malarial patients with comparison to the normal subjects. It is concluded that further research in the area of antioxidant therapy and use of Copper as marker will extensive the study.

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