

# Assessment of serum Copper and Calcium among newly diagnosed Tuberculosis patients in Khartoum state.

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## ABSTRACT

**Background:** Tuberculosis (TB) is a global health problem, responsible for more than 2 million deaths each year. TB kill more adults than any other disease; especially in developing countries.

**Objective:** The aim of this study was to assess the levels of calcium and copper among newly diagnosed tuberculosis patients in Khartoum State -Sudan.

**Methods:** A case control study was conducted from July to November 2018, involving 50 Sudanese patients who had been newly diagnosed with tuberculosis and had been admitted to Abo Anga Hospital, Omdurman at Khartoum State, as cases, and 50 age-matched healthy individuals were recruited as controls. Blood samples were collected from each participant. Assessment of serum calcium and copper were measured, using atomic absorption Spectrophotometer. Data analysis was carried out, using SPSS version 21.

**Results:** In this study there were significant decreased in the mean of copper and calcium levels in newly diagnosed tuberculosis patients compared to control group (mean  $\pm$  SD) for calcium cases versus control: (4.60 $\pm$ 3.09 versus 8.95 $\pm$ 0.44 mg/dl, p=0.000) for copper (0.46 $\pm$ 0.2 versus 12.96 $\pm$ 0.86 mg/dl p=0.000). There were insignificant different in the mean levels of calcium and copper according to gender, calcium (4.27 $\pm$ 3.06 versus 4.99 $\pm$ 3.15 mg/dl, p=0.420) for copper, (0.44 $\pm$ 0.26 versus 0.49 $\pm$ 0.29 mg/dl, p=0.577). The result showed there were no correlation between copper, calcium and age (R= 0.144 p=0.317) for copper, (R= 0.065 p=0.655) for calcium. The result showed there was strong positive correlation between calcium and copper (R= 0.754 p=0.000).

**Conclusion:** The levels of calcium and copper were decreased in newly diagnosed tuberculosis patients compared to control group. There was strong positive correlation between calcium and copper.

**KEYWORDS:** Tuberculosis, copper level, calcium level, control group.

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## I. INTRODUCTION

Tuberculosis (TB) is an olden disease from the past of human life. It is a disease associated with low socio-incoming nations; approximately 3 million fatalities reported in 2014 occur yearly and approximately five deaths happen in each minute. TB leftovers the solitary infectious virus and is the source of the uppermost death in person. It is only second leading cause of fatality to human immunodeficiency virus. TB is bacterial infections illness caused by mycobacterium tuberculosis (tubercle bacillus or acid fast bacilli). Initially bacilli enter in the lungs and causes disease termed as pulmonary tuberculosis (PTB) [1].

Mycobacterium tuberculosis infect one-third world's population, of whom above 80% live in developing countries like India [1]. Annually, more than 8 million people have developed TB and approximately with 1.8 million death [3]. Micronutrient like copper play important role in many biological system such as, biochemical reactions in metabolism, maintenance of nutritional health, growth of the human tissues and organs [4].

Copper and calcium are essential components for growth and development of human body. Copper play an important role in multiple enzymatic reactions with varied physiological roles from melanin production to wound healing to electron transport [5]. Variation in distribution of copper in body tissues is known to occur in chronic infection. Calcium is macronutrient used for evaluation of nutritional status of patients with tuberculosis [6]. Calcium plays a critical role in cardiac and vascular smooth muscle function [7]. The deficiency of calcium may lead to irritable nervous muscular symptoms, convulsions, bleeding diathesis, capillary haemorrhages, tissue exudation and osteomalacia [8]. Calcium is macronutrient used for evaluation of nutritional status of patients with tuberculosis [8].

## II. MATERIALS AND METHODS

### Study design, area, and duration

This was a case control study conducted in Abo - Anga Hospital, in Khartoum State, from April to July 2018.

### Study population

Fifty Sudanese patients with TB, were recruited as cases and fifty normal individual were enrolled as controls. The cases and control were age-matched; 23 of patients were females and 27 were males, and 22 of controls were females, and 28 of them were males.

### Inclusion criteria

Newly diagnosed TB patients were included in this study.

### Exclusion criteria

Patients with other disease that affect the serum copper and calcium levels such as liver diseases, previous anti-TB treatment, use supplementation containing copper. Patients that refuse to participate in this study were excluded.

### Ethical consideration

The study was approved by the Ethical committee of Medical Laboratory Science, Clinical Chemistry Department-Alneelain University. Informed consent was obtained from each the participant.

### Data collection

Demographic data was collected by using non self-administered questionnaire.

### Sampling

About 3 ml of random venous blood was collected from each participant (from the arm), into plain sample container. After clot formation at room temperature, the samples were centrifuged for 10 minutes at 3000 rpm. Then, the serum was obtained and analyzed.

### Method of the assay of copper and calcium

The levels of serum copper and calcium were measured by using atomic absorption spectrophotometer (BUCK SCIENTIFIC 210/211 VGP VER3.94C).

### Quality control

Pathological and normal control sera were also used for the measurement of the metals, to assure accuracy and precision of results.

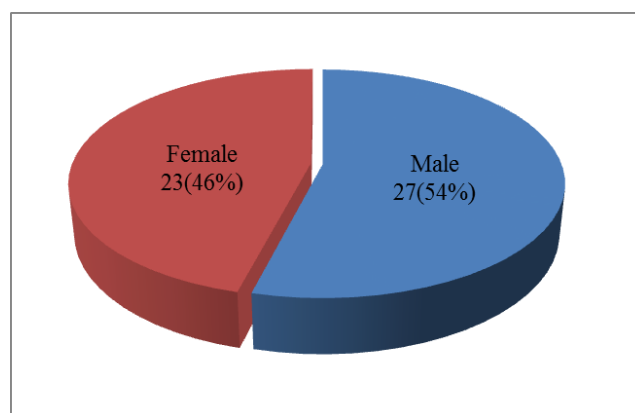
### Data analysis

Data was analyzed using SPSS, version 21. The results were expressed as percentages, mean and SD. Independent t-test was used to compare mean values in case versus the control group. Pearson's correlation test was done to study the relationship between calcium, copper and age, p-value less than 0.05 was considered significant.

## III. RESULTS

Hundred participants were enrolled in this study; 50 patients with TB (23 of patients were females and 27 were males) as in figure (1),

Figure (1): Distributions of patients according to genders



The levels of copper and calcium for these patients were as follow, (mean ± SD) for calcium cases versus control: (4.60±3.09 versus 8.95±0.44 mg/dl, p-value 0.000) for copper (0.46±0.2 versus 12.96±0.86 mg/dl, p-value 0.000) (There were significant different), as in table (1)

Table (1) Comparison of means concentration of calcium and copper among study groups

Parameters	Control (Mean±SD)	Case (Mean±SD)	p-value
Calcium (mg/dl)	8.95±0.44	4.60±3.09	0.000
Copper (mg/dl)	12.96±0.86	0.46±0.27	0.000

P-values less than 0.05 were considered as significant.

There were insignificant deferent in the levels of calcium and copper among patients with TB according to gender as in table (2).

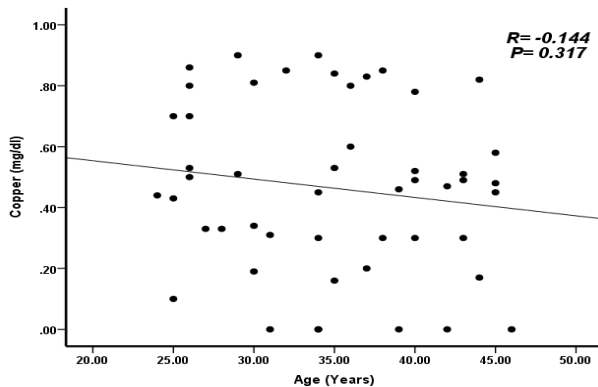
Table(2) Comparison of means concentration of calcium and copper according to gender

Parameters	Female (Mean±SD)	Male (Mean±SD)	P-value
Calcium (mg/dl)	4.99±3.15	4.27±3.06	0.420
Copper (mg/dl)	0.49±0.29	0.44±0.26	0.577

P-values less than 0.05 were considered as significant.

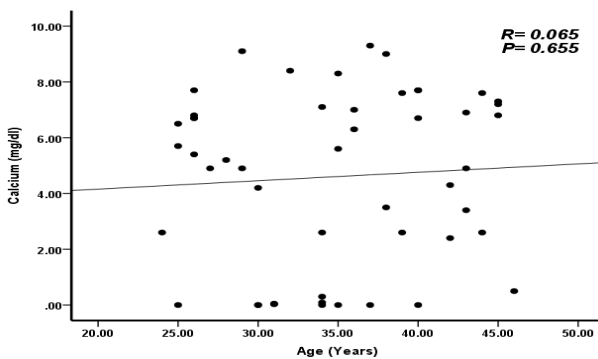
The result showed there was no correlation between copper and age ( $R= 0.144$   $p=0.317$ ) as in figure (2).

**Figure (2): Correlation between copper and age**



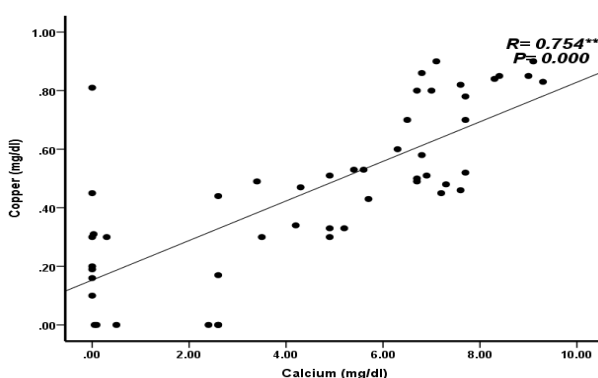
The result showed there was no correlation between calcium and age ( $R= 0.065$   $p=0.655$ ) as in figure (3).

**Figure (3): correlation between calcium and age**



The result showed there was significant positive correlation between calcium and copper ( $R= 0.754$ ,  $p=0.000$ ) as in figure(4).

**Figure (4): correlation between calcium and copper**



#### IV. DISCUSSION

Tuberculosis (TB), TB is a disease caused by mycobacteria, is a more common and often deadly infectious disease [9]. The main cause of impaired immunity

is the deficiencies of micronutrient and thereby lead to increase susceptibility to infections such as tuberculosis [10].

The present study was carried out to estimate serum calcium and copper levels in patients with pulmonary tuberculosis. It was observed in this study, that, 23 of patients were females and 27 were males. This study in agreement with another study, which found that 73.41% of the study population consisted of males [11].

In this study, the levels of copper and calcium in patients with tuberculosis showed a significant decrease when compared to a healthy individual. This result similar to another result which reported that the level of copper was significant decrease in patients with tuberculosis ( $p < 0.05$ ) [12]. Also, this result agreed to another result carried by many authors [13]. Also, the result is similar to another result, which reported that there was significantly decrease in calcium level in patients with tuberculosis [14]. The result disagreed with another result which finding confirmed that there was a significant increase in serum calcium in pulmonary tuberculosis patients when compared to normal individual [15]. Similarly, this result disagreed with another result carried out by Peacock, (2010), his finding confirmed that this increased may be due to increasing entry of calcium within extracellular fluid partition such as from skeleton and the intestine and kidney. This elevated mostly in tuberculosis, dehydration and hyper albuminaemia. Some of the causes of hypercalcemia are hyperparathyroidism, vitamin D-intoxification, malignancy, immobilization infection, inflammation, inheritance, endocrine disorders, and genetic disorders. In pulmonary tuberculosis unbalanced performance of parathyroid gland resulting in surplus production of parathyroid hormone [16].

Another result reported that an elevated level of calcium has been found in disseminated tuberculosis patients and pulmonary tuberculosis patients with pleural effusion. Protein energy malnutrition and hypoalbuminemia are mainly findings in patients with hypercalcemia in tuberculosis. Vitamin D (25 hydroxycholecalciferol and 1, 25 dihydroxycholecalciferol) act in pathogenesis by activation of cell-mediated immunity in pulmonary tuberculosis, this may cause hypercalcemia [17].

In this study, there was no significant difference in the mean of calcium and copper according to gender ( $p=0.420$ ,  $0.577$ ) respectively. This result is similar to another result which showed there were no significant difference in the mean of calcium and copper according to gender [18].

The result showed there were no correlation between copper, calcium and age ( $R=0.144$ ,  $p=0.317$ ) ( $R= 0.065$ ,  $p=0.655$ ) respectively. This result disagreed with another result which reported, that calcium absorption decreases with age [19]. Also, this result different to another result carried out by Suárez-Ortegón and his colleges, (2011), which reported that Serum copper level was negatively correlated with age ( $r = -0.184$ ,  $p = 0.032$ ) [18].

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The result showed there was a significant positive correlation between calcium and copper ( $R= 0.754, p=0.000$ ). This result disagreed with another result which finding confirmed that there was a negative correlation between serum calcium and copper ( $r = -0.339, p = 0.005$ ) [18].

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