

# Evaluation of Serum Copper and Zinc Among Sudanese Patients with Hypertension

Sahar Dawelbait, AbdElkareem A. Rabo, Sheereen Fiasal, Suhair A. Ahmed  
Alneelain University-Faculty of Medical Laboratory Science- Clinical Chemistry Department

**Abstract :-** The regulation of trace elements in blood and their storage in the cells occur by a particular system to manage the amount of these elements in normal levels. If this system doesn't work in a proper manner, these elements may have aberrantly levels and ratios. Increased levels of Copper and decreased Zinc levels are the most common interruptions that happened to this system. In this study serum Copper and Zinc were measured among both hypertensive and normotensive subjects. The study was conducted after formal approval from Alneelain University and from each involved subject. Low levels of both copper and zinc were found among hypertensive subjects when compared with normotensive subjects.

**Keyword:-** Hypertension, Copper, Zinc and Trace elements.

## I. INTRODUCTION

Elevated blood pressure is accompanied with ischemic heart disease, stroke risks<sup>1</sup>, heart failure, and renal disease<sup>2</sup>, plus earlier mortality<sup>3</sup>. Although it is associated with elder individuals, its occurrence is found in young ones<sup>4</sup>. Even so, young adults that might be diagnosed as hypertensive patients according to the diagnostic criteria have a lower prevalence of an elevated blood pressure diagnosis than middle-aged and elder adults<sup>5</sup>. In 2005-2006, about 30% of adults in United States of America lived with hypertension (systolic blood pressure  $\geq 140$  mm Hg or diastolic blood pressure  $\geq 90$  mm Hg), and 28% of US adults had prehypertension (systolic pressure of 120-139 mm Hg or diastolic pressure of 80-89 mm Hg), according to this they are at increased risk of having hypertension<sup>6</sup>. Elevated blood pressure is a silent disease; as many as 20% of hypertensive individuals with no symptoms and they do not know that they are diseased<sup>6</sup>. Individuals who are unaware that they have hypertension for years might have irreversible damage. Complications might happen for several reasons among individuals who are aware that they have the disease; for example not having medical care, or not being well educated about treatment options<sup>7-8</sup>, also not controlling their blood pressure<sup>6-9-10-11</sup>, and failing to commit to the prescribed medications<sup>12-13</sup>.

The system for handling and controlling the amount of key trace elements circulating in human blood and their storage in the cells is an exhaustive one. The metals from the diet are assimilated into the blood, if blood levels are diminished, shift into cells, if cellular levels are not enough, or excreted if blood and cell levels are sufficient or overloaded. If the system can't function in a proper manner, abnormal levels and ratios of trace

elements might occur. One of the commonest trace elements disturbances is increased levels of Copper and decreased Zinc. The ratio of these elements to each other is clinically of much importance than their concentration<sup>14</sup>.

Two to four grams of Zn is distributed in human body<sup>15</sup>. The highest concentrations of it is in the prostate, semen and parts of the eye, also it is found in the brain, muscle, bones, kidney and liver<sup>16</sup>. Zinc is a unique element that is found in all enzyme classes adding to this it comes after iron as the second plentiful transition element in organisms<sup>15-17</sup>.

Copper is an important dietary nutrient, despite this little amounts of it are needed for being healthy<sup>18</sup>. There is only 75-100 milligrams of copper in human body, despite this little amount it comes after iron and zinc as the third most existing trace element<sup>19</sup>. It is distributed in every part of the body. It's mainly stored in the liver, with little quantity in the brain, heart, kidney, and muscles<sup>20</sup>.

Zn participates in so many parts of cellular metabolism<sup>21</sup>. About 10% of man proteins potentially attach to zinc, plus hundreds proteins that convey and circulate zinc. More than 200 enzymes need Zn for their catalytic activity<sup>22-23</sup> also is needed for immunity<sup>23-24</sup>, wound healing<sup>23</sup>, protein synthesis, DNA synthesis and cell division<sup>25</sup>. Zn has a role in controlling the sense of taste and smell<sup>26-27</sup> also supports normal growth and development during pregnancy, childhood, and adolescence<sup>28-29</sup>.

## II. MATERIALS AND METHODS

A case – control study done in Khartoum Sudan, involved 100 subjects divided into two groups; hypertensive group and healthy group; they were 50 % to 50 %, each group contained 25 male and 25 females, patients who attended medicine department for regular checkup, mean $\pm$ SD of their age was (55 $\pm$ 10) years, blood samples were collected under hygienic conditions, preserved serum at -20C<sup>0</sup>. Then analyzed for measurement of copper and zinc minerals by means of spectrophotometric method, using BTS 350 chemical analyzer at Alneelain University –faculty of medical laboratory science, clinical chemistry section.

## III. RESULTS

100 of subjects were included for evaluation of copper and zinc, they were 50 hypertensive and 50 healthy subjects. Copper level mean $\pm$ SD was 0.121 $\pm$ 0.058 mg/L for patient

group and  $(0.982 \pm 0.355)$  for control group. Zinc level (mean $\pm$ SD) was  $0.271 \pm 0.132$  mg/L for patients and  $0.856 \pm 0.310$  for control group. Both minerals were measured brought significant difference among hypertensive group when compared with control group, they were lower levels among patients than control group and each has p value 0.000 as in table 1 and figures 1 and 2.

Parameters	Hypertension (Mean $\pm$ SD)	Control (Mean $\pm$ SD)	P-value
Copper (mg/L)	$0.121 \pm 0.058$	$0.982 \pm 0.355$	0.000
Zinc (mg/L)	$0.271 \pm 0.132$	$0.856 \pm 0.310$	0.000

Table 1. Comparison of copper and zinc levels between hypertensive and control subjects.

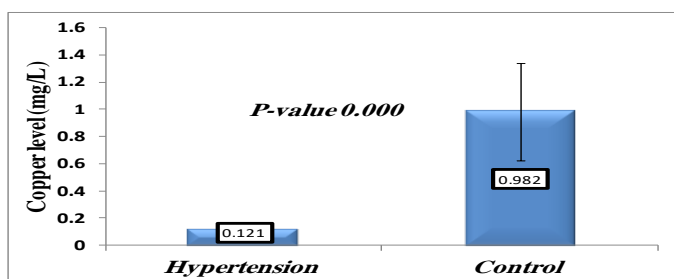


Fig 1:- Copper levels among hypertensive individuals and control group.

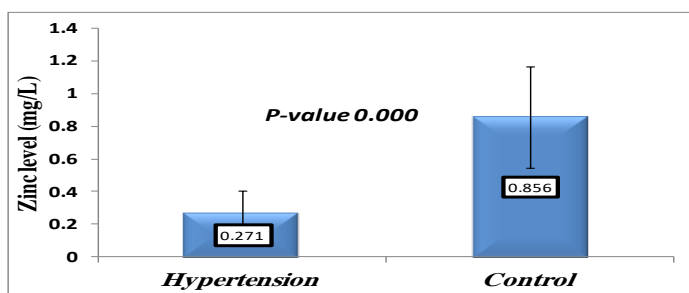


Fig 2:- Zinc levels among hypertensive individuals and control group.

#### IV. DISCUSSION

The layers of earth contain a considerable amount of metals and they differ in their contents among many regions, this results in spatial variations of encompassing concentrations. The spread of metal in the atmosphere is determined by its properties and by different environmental factors<sup>30</sup>. Thirty five metals have importance to us because of residential or occupational exposure, and twenty three of these are heavy metals, copper and zinc both belong to them<sup>31</sup>.

Worldwide there are one billion with hypertension, which is associated with approximately 7.1 million deaths per year<sup>32</sup>. Despite that number of important nutritional and metabolic factors for elevated blood pressure are identified, such as low intake of fruits, vegetables, and potassium; increased sodium (sodium chloride) intake; excess body weight; inadequate physical activity; and excess alcohol intake<sup>33-34</sup>, it is important to consider that many other factors also play a role in this heterogeneous disorder. One of these factors, in particular, is the influence of essential trace elements, like copper and zinc on blood pressure. The involvement of copper and zinc in blood pressure regulation is particularly hinted in the human studies via manipulation of dietary copper and zinc levels<sup>35</sup>. Several methods have been applied to assay trace metals in human studies. First, the metal concentration can be measured in plasma<sup>36</sup>, serum and urine<sup>37</sup>. The turnover rate of trace metals in the blood is rapid<sup>38</sup>. The absorption of Zn in the small intestine is controlled by a carrier-mediated mechanism<sup>39</sup>. Under normal physiologic conditions, transport processes of uptake are not saturated. It is not easy to determine the fraction of zinc absorbed because it is also secreted into the gut. About 60-70% of administered zinc in water soluble forms given to fasting individuals is absorbed efficiently, on the other hand absorption from solid diets is less efficient and differs depending on zinc content and diet composition<sup>40</sup>.

In this study hypertensive patients were targeted for measurement of copper and zinc, both of them brought lower levels with significant difference as p value for each one was (0.000), different studies were focusing on copper and zinc around the world, as in Chandigarh which is a city of high occurrence of hypertension in India both mineral were measured in hypertensive and normotensive subjects, as for copper an agreement obtained as both studies revealed low concentration of it, while measuring of zinc in the hypertensive subjects revealed low level<sup>41</sup>. Other study found out lower copper among hypertensive people as well<sup>42</sup>. Other same findings were obtained through monitoring of zinc and copper, and that study suggested that neither copper nor zinc correlated to blood pressure<sup>43</sup>.

#### V. CONCLUSION

Zinc and copper among hypertensive levels were found lower than normal healthy subjects.

#### VI. RECOMMENDATION

Regular mineral analysis should be planned for individuals with hypertension, as they may develop certain abnormality leading to fatal effects.

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