

Estimation of Serum Copper and Zinc in Anemic Patients. Findings from A Tertiary Care Hospital, Andhra Pradesh.

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Abstract

INTRODUCTION: Anemia is a major public health problem in India and is often associated with decreased trace element such as copper, zinc and increase in heavy metals such as Lead. the present study has been conducted with an objective to estimate serum copper and zinc levels among anemic patients. **MATERIAL & METHODS:** It was a hospital based retrospective study conducted at a tertiary care hospital from Vijayawada. A pre designed schedule was designed to get the relevant data. Data on 100 admitted anemia patients was taken from the hospital case records using that schedule. Study variables included demographic characteristics, clinical characteristics, biochemical parameters assessment including Hb, Copper, Zinc levels. **RESULTS:** A total of 100 hospital case records data was analyzed. Mean age of the study population was 42.57 ± 11.8 years with majority (31%, n=31) belonging to 41-50 years age group. Mean duration since they were detected as Anemic was 5.7 years and majority were detected during routine checkups. Gender wise distribution showed that more than half the proportion (64%, n=64) being females. Mean values of Zinc and Copper levels among anemic patients was $45.12 \mu\text{g/dl}$ and $72.83 \mu\text{g/dl}$ respectively. **CONCLUSIONS:** Compared to the standard reference values, the levels of Zinc and serum copper levels was low among anemic patients. Hence it is imperative to screen anemic patients for the trace and heavy metals so that proper medical care can be given to the patients.

Keywords: anemia, copper, zinc levels, estimation

Date of Submission: 06-12-2021

Date of Acceptance: 21-12-2021

I. Introduction

Anemia is a condition in which the number of red blood cells or the hemoglobin concentration within them is lower than normal. Hemoglobin is needed to carry oxygen and if you have too few or abnormal red blood cells, or not enough hemoglobin, there will be a decreased capacity of the blood to carry oxygen to the body's tissues. This results in symptoms such as fatigue, weakness, dizziness and shortness of breath, among others. The optimal hemoglobin concentration needed to meet physiologic needs varies by age, sex, elevation of residence, smoking habits and pregnancy status^[1,2].

The most common causes of anemia include nutritional deficiencies, particularly iron deficiency, though deficiencies in folate, vitamins B12 and A are also important causes; haemoglobinopathies; and infectious diseases, such as malaria, tuberculosis, HIV and parasitic infections. Anemia is a serious global public health problem that particularly affects young children and pregnant women. WHO estimated that 42% of children less than 5 years of age and 40% of pregnant women worldwide are anemic^[1]. According to National Family Health Survey (NFHS 5) report in India, as many as 68.4 percent children and 66.4 percent women surveyed suffered from anemia in 2019; 35.7 per cent children and 46.1 per cent women were anemic in 2016^[3].

Copper levels in tissues and body fluids depend on diet, state of health, sex, and age. It is a component of at least 16 mammalian metalloprotein, many of which are central to hematopoiesis, bone and connective tissue physiology, and parts of nervous system^[4,5]. Copper toxicity is rare, resulting in nausea, vomiting, hemodialysis, hepatic necrosis, oliguria, azotemia, convulsions, and coma^[6]. Copper plays a critical role in human metabolism. It acts as a cofactor of key metabolic enzymes, which are involved in respiration, neurotransmitter biosynthesis, radical detoxification and iron metabolism. The average daily intake of copper is

between 1 mg and 3 mg, and this amount is adequate for bodyneeds. However, in lower socio-economic groups chances of copperdeficiency exist ^[7,8]. Copper is an essential trace element, playing acritical role in multiple functions in the body. Copper has an importantrole in maintaining good health. When paired with iron, it helps created blood cells. It also helps keep blood vessels, bones, nerves, and theimmune system healthy. Humans typically ingest copper by drinkingwater from copper pipes and eating foods such as nuts, some fruitsand vegetables, shellfish, and red meat. Zinc is an antioxidant, micronutrient that has been playing a verysignificant role in maintaining immune function and neutralizing thereactive oxygen intermediates produced by activated macrophages andneutrophils in their response to micro-organisms.The present study was conducted with an objective to estimateserum copper and zinc levels among anemic patients admitted at a tertiary care hospital in Andhra Pradesh, India.

II. Material & Methods

It was a hospital based retrospectivestudy conducted at a tertiary care hospital from Vijayawada, Andhra Pradesh, India. The duration of the study was three months between August and October 2021. Data on 100 hospital case records was analyzed for the study. Selection of the case records was done randomly using simple random sampling technique.

Inclusion criteria- Those who were anemic and admitted in the hospital were included in the study.

A pre designed questionnaire was designed to get the relevant data. Demographic data, clinical characteristics, biochemical parameters assessment including Hb, Copper, Zinc levelswas also taken from the case records.Data was entered in Microsoft Excel 2010 version and analyzed using Open Epi software version 3.01. Numerical data was presented in mean and standard deviation and categorical variables in percentages and proportions.

III. Results:

A total of 100 hospital case records data was analyzed. Mean age of the study population was 42.57±11.8 years with majority (37%, n=37) belonging to 41-50 years age group. Mean duration since they were detected as Anemic was 5.7 years and majority were detected during routine checkups. Gender wise distribution showed that more than half the proportion (64%, n=64) being females.

With regards to literacy status, one third (33%) of them were illiterates and regarding occupation, majority (58%) were unemployed. This reason could be due to majority were female and home makers by occupation.Regarding symptoms, two thirds (68%) were did not show present with any symptoms and were asymptomatic and accidentally diagnosed as Anemiaduring normal checkups.

Table 1: Demographic & clinical characteristics of the study population

| Demographic & clinical characteristics | | No. (%) |
|--|--------------------------------------|----------|
| Age groups | 21-30 | 22 (22%) |
| | 31-40 | 37 (37%) |
| | 41-50 | 23 (23%) |
| | 51-60 | 18 (18%) |
| Gender | Male | 36 (36%) |
| | Female | 64 (64%) |
| Literacy status | Illiterate | 33 (33%) |
| | Literate | 67 (67%) |
| Occupation | Employed | 42 (42%) |
| | Unemployed | 58 (58%) |
| Symptomatology | Asymptomatic | 68 (68%) |
| | Symptomatic | 32 (32%) |
| Detection of Anemia | Accidentally during normal check ups | 72 (72%) |
| | Due to Anemic symptoms & signs | 28 (28%) |

Mean value of Hemoglobin level among anemic patients in the present study was 7.27±2.5 gm/dl and mean duration since they were detected as Anemic was 5.7 years. Though they were diagnosed since years, only a few proportion of the patients were taking medications for Anemia. This could be reason for deterioration of the condition of the patient and getting admitted in the hospital.

Table 2: Serum Hb, Copper and Zinc levels of the study population

| Variable | Mean±SD |
|----------------------|------------|
| Hb (gm/dl) | 7.27±2.5 |
| Serum Copper (µg/dl) | 72.83±11.6 |
| Serum Zinc (µg/dl) | 45.12±6.4 |

Mean values of Zinc and Copper levels among anemic patients was 45.12 µg/dl and 72.83 µg/dl respectively. When compared to the standard reference values, the mean values of serum zinc and copper levels was low. In about half proportion (42%) of the study population, the values of serum zinc and copper levels was lower.

IV. Discussion

Present study findings were in concurrence with findings by Aishwarya S et al (2016)^[9] from Tamil Nadu where mean values of copper and zinc levels were significantly lower in anemic group compared to control group. In their study, mean values of zinc are 47.04 µg/dl in anemic patients which is significantly lower than the control group. The mean value of copper is 76.327 µg/dl in anemic patients which is significantly lower than the control group. The only difference from the present study was that, there was no control group in the present study because study by itself was a retrospective record based study.

Another study by Amal A Hegazy et al (2010)^[10] from Egypt observed that approximately 63.33% of children had blood lead levels ≥ 10 µg/dl. At the blood lead level range of 10-20µg/dl, a significant association was found for mild and severe anemia. The blood level of iron and ferritin was found to be significantly lower in high blood lead level and anemic groups than those of the low blood lead level and control groups. Comparing the results of Cu, Fe and Zn levels between the anemic and control groups, study revealed a significant decrease in the level of Fe among the anemic than the control group ($p < 0.001$). Whereas no statistically significant difference was seen between both groups for Cu and Zn levels. The contrast issues from the present study were that again the study had control group and study population were children from a pediatric clinic compared to adult age group in present study.

In one of the study in USA, anemia is typically normocytic or macrocytic and rarely microcytic with copper deficiency and is of variable severity depending on the degree of copper deficiency^[11].

A study on relation between serum iron and copper levels in pregnant females of Uttarakhand, India by Naithani et al (2015)^[12] found that the percentage of anemia among pregnant women of present study was 46.62%. In present study 58.3% of the pregnant women were found to have high copper levels and 71.42 % of the anemic pregnant women had high copper levels. Compared to present study, percentage who had high copper levels was high; this difference could be due to different study population.

Anemia which is one of the major nutritional and public health problem in India. To tackle this problem, Ministry of Health and Family Welfare, Government of India had launched various national health programs and schemes time to time such as National Nutritional Anemia prophylaxis Programme and the recent initiative "Anemia Mukta Bharat". But it is imperative to screen for trace elements also such as Copper and Zinc levels to effectively control the problem.

V. Conclusions:

Compared to the standard reference values, the levels of Zinc and serum copper levels was low among anemic patients. Hence it is imperative to screen anemic patients for the trace and heavy metals so that proper medical care can be given to the patients. Apart from correcting the hemoglobin levels, it is important to correct these micronutrients through dietary modifications.

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Dr.MattaSreevani, et. al. "Estimation of Serum Copper and Zinc in Anemic Patients. Findings from A Tertiary Care Hospital, Andhra Pradesh." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 20(12), 2021, pp. 21-24.