

Serum Zinc and Copper Levels in Aplastic Anemia

Mean serum zinc and copper levels were measured in pediatric patients with idiopathic aplastic anemia. Zinc levels were significantly lower in patients compared to controls and correlated with severity of disease. Serum copper levels were significantly higher in patients. There was no correlation with severity of disease. Cu/Zn ratio also correlated with severity of disease.

Key words: *Aplastic anemia, Copper, Trace elements, Zinc.*

Role of zinc and copper has been studied extensively in health and disease. Zinc is necessary for optimum performance of immune function and deficiency results in increased morbidity due to infections especially gastrointestinal and respiratory [1, 2]. Alterations in serum levels of zinc and copper have also been studied in several malignant and lymphoproliferative disorders [3, 4]. There are no studies in patients with aplastic anemia. Aim of this study was to evaluate the serum levels of zinc and copper in pediatric patients with idiopathic aplastic anemia at the time of diagnosis and to correlate the levels with severity of disease.

45 patients with newly diagnosed idiopathic aplastic anemia in the age group of 4 to 15 years admitted in pediatric ward over 18 months were included in the study. Inclusion criteria were: at least two of the following (i) hemoglobin <10 g/L (ii) platelet count <50 × 10⁹/l (iii) neutrophil count <1.5 × 10⁹/l with a hypocellular bone marrow (cellularity <25%) [5]. Inherited bone marrow failure syndromes were excluded from study based on cytogenetics and chromosomal fragility test. Severity of

disease was graded according to published criteria [6]. 40 age and sex matched healthy children served as controls. 5 mL venous blood was collected in deionized plastic tubes for estimation of zinc and copper by atomic absorption spectrophotometer. Statistical analysis was done using SPSS software version 16.0.

Median age of the study group was 8.9 years (range 4-15 years). 48.5% of patients and 44.4% controls had weight for age below 3rd centile. Study and control groups were comparable in their nutritional status. 7 patients had very severe, 27 had severe and 11 had non severe aplastic anemia. Mean serum zinc level was 33.87 ± 16.29 µg/dL in study group and 140.26 ± 55.37 µg/dL in control group (**Table I**). Difference was statistically significant (*P* value <0.001). Serum zinc levels had significant correlation with disease severity. Patients with very severe aplastic anemia had lowest levels of zinc (*P* <0.001). Serum copper levels were 122.65 ± 49.02 µg/dL in patients and 77.25 ± 18.58 µg/dL in control group (*P* <0.001). There was no correlation with disease severity. Copper-zinc ratio was higher in the study group and correlated with disease severity (*P* <0.001).

Our results demonstrated significantly low levels of serum zinc in patients with aplastic anemia which correlated with disease severity. Zinc deficiency may further compromise the low immunity seen in these patients as zinc plays a vital role in immune function. Similar trend was seen for copper zinc ratio. We also observed increased serum levels of copper in the patients although the levels did not correlate with severity of

TABLE I MEAN SERUM COPPER AND ZINC LEVELS, AND COPPER-ZINC RATIO IN CHILDREN WITH APLASTIC ANEMIA AND CONTROLS

<i>Study Subjects*</i>	<i>Number of cases</i>	<i>Serum copper levels (µg/dL) Mean ± SD</i>	<i>Serum zinc levels (µg/dL) Mean ± SD</i>	<i>Cu/Zn ratio Mean ± SD</i>
Very severe aplastic anemia	07	156.35 ± 34.43	23.15 ± 4.59**	6.8 ± 1.33**
Severe aplastic anemia	27	113.96 ± 50.87	31.61 ± 14.39**	4.08 ± 1.98**
Non-severe aplastic anemia	11	125.31 ± 45.72	47.53 ± 18.62**	2.82 ± 1.17**
All aplastic anemia cases	45	122.65 ± 49.02***	77.25 ± 18.58***	4.21 ± 2.1***
Controls	40	33.87 ± 16.29	140.26 ± 55.37	0.55 ± 0.34

****P* < 0.0001; ***P* < 0.001; *Severity of disease graded as per ref 6.

disease. Similar alterations and an inverse relationship between zinc and copper levels have been previously observed in childhood leukaemia and lymphoma where they have been used to monitor the disease severity and relapse [7]. Increased uptake of zinc from serum because of increased metabolism has been suggested as a possible mechanism for low zinc levels [8]. Similar mechanisms may be operative in patients with aplastic anemia but needs more investigation. This is a new area of research and there are no other studies to make a comparative analysis of our results. Correlation with treatment outcome would be an interesting application of this study.

Contributors: VG designed the study and prepared the manuscript. AK collected the data and searched the literature. RKA helped in the analysis of samples.

Funding: None; *Competing interests:* None stated.

VINEETA GUPTA, AKASH KUMAR AND RAVI KASTHANA
*Department of Pediatrics and *Department of Botany,
 Faculty of Science, Institute of Medical Sciences,
 Banaras Hindu University,
 Varanasi 221 005, Uttar Pradesh, India.
 vineetaguptabhu@gmail.com*

REFERENCES

1. Rink L, Haase H. Zinc homeostasis and immunity. *Trends Immunol.* 2007;28:1-4.
2. Yakoob MY, Theodoratou E, Jabeen A, Imdad A, Eisele TP, Ferguson J, *et al.* Preventive zinc supplementation in developing countries: impact on mortality and morbidity due to diarrhoea, pneumonia and malaria. *BMC Public Health.* 2011;3:S23.
3. Gupta SK, Shukla VK, Gupta V, Gupta S. Serum trace elements and Cu/Zn ratio in malignant lymphomas in children. *J Trop Pediatr.* 1994;40:185-7.
4. Alexander FW, Delves HT, Lay H. Plasma copper and zinc in acute leukaemia. *Arch Dis Child.* 1972;47:671.
5. International Agranulocytosis and Aplastic Anaemia study. Incidence of aplastic anemia: relevance of diagnostic criteria. *Blood.* 1987;70:1718-21.
6. Camitta BM, Rapoport JM, Parkman R, Nathan, DG. Selection of patients for bone marrow transplantation in severe aplastic anemia. *Blood.* 1975;45:355-63.
7. Tessmer CF, Hrgovic M, Wilbur J. Serum copper in Hodgkin's disease in children. *Cancer.* 1973;31:303-15.
8. Delves HT, Clayton BE, Bicknell J. Concentration of trace metals in the blood of children. *Br J Prev Soc Med.* 1973;27:100-7.

Nutritional Status of Tripuri Tribal Adolescent Boys of West Tripura District

This cross-sectional study assesses the growth and nutritional status of 623 rural and urban Tripuri tribal adolescent boys (aged 8 to 15 years) from West Tripura district. Prevalence of stunting, thinness and overweight were observed 7.6%, 17.81% and 6.03% for urban and 27.9%, 38.37% and 0.39% respectively for rural boys.

Key words: *Nutritional status, Rural-urban, Tripuri tribe.*

Assessing the growth and nutritional status of children and adolescents is an essential part of monitoring the health of a population or a community [1]. Few studies [2,3] on tribal children have been published from the northeastern part of India. The *Tripuri* tribe constitutes more than half of all the 19 tribes found in the state of Tripura and about 16% of total state population. The present study was undertaken to assess and compare the growth and nutritional status of *Tripuri* tribal adolescent boys (aged 8-15 years) from rural and urban areas of West Tripura district.

This cross-sectional comparative study was conducted in selected public schools in rural and urban localities of West Tripura district. Data were collected from volunteers (258 rural and 365 urban *Tripuri* tribal boys, aged 8 to 15 years), using random sampling method. The socioeconomic status of each subject was assessed by modified Kuppuswamy's scale. Data were collected after obtaining assent from each subject. The study was carried out in accordance with the revised ethical guidelines for human experimentation of Helsinki Declaration of 2000 [4]. Standing height (cm) and the weight (kg) was measured following standard recommendations [5], and body mass index (BMI) was also calculated. The age of each subject was recorded from school register and cross-checked from birth certificates. Indices of undernutrition such as stunting, thinness and overweight were calculated according to the classification of World Health Organization (WHO) [6], using the 2007 WHO growth reference data for 5-19 years [7].

All the rural *Tripuri* tribal boys belonged to the lower socio-economic class whereas urban boys belonged to the upper middle socio-economic class. The overall prevalence of stunting, thinness and overweight were observed 7.7%, 17.8% and 6%, respectively for urban boys and 27.9%, 38.4%, and 0.39%, respectively for rural