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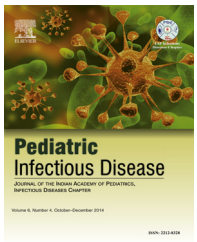

Original Article

Serum zinc levels in children 6 months–12 years having tuberculosis

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ABSTRACT

Background: Tuberculosis is one of the most serious health problems in our country.

The association between tuberculosis and malnutrition is well recognized. Tuberculosis can lead to malnutrition, and malnutrition may predispose to tuberculosis. The micronutrient status in tuberculosis is affected significantly. Among the micronutrients, zinc plays a very important role as far as cell-mediated immunity is concerned. Limited data are available on the relationship between zinc levels and tuberculosis in childhood.

Aim: The present study was designed to estimate the serum zinc levels in children with tuberculosis and in children with malnutrition, and to compare the serum zinc levels between them.

Methods: Our study was conducted on 100 children in the age group of 6 months–12 years reporting to Department of Pediatrics, Rajindra Hospital, Patiala, out of which 50 children were those affected by tuberculosis and 50 children were those with malnutrition without tuberculosis. 50 age- and sex-matched children were taken as control.

Results: It was observed that the mean serum zinc levels in TB were 45.18 ± 10.05 μg/dl, in PEM were 53.04 ± 7.13 μg/dl while in controls they were 86.84 ± 15.92 μg/dl. It was seen that serum zinc levels were significantly low in children with TB as compared to controls ($p < 0.0001$). Serum zinc levels were found to be significantly low in children with PEM (but without TB) as compared to controls ($p < 0.0001$). Also, serum zinc levels were significantly low in children with TB when compared to children with PEM (without TB) ($p < 0.05$).

Conclusion: Serum zinc levels are significantly affected in tuberculosis.

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Abbreviations: ANOVA, analysis of variance; CNS, central nervous system; CRP, C-reactive protein; CSF, cerebrospinal fluid; ESR, erythrocytic sedimentation rate; FNAC, fine needle aspiration cytology; HS, highly significant; IAP, Indian Academy of Pediatrics; NS, non-significant; PEM, protein energy malnutrition; SD, standard deviation; S, significant; TB, tuberculosis; ZN STAIN, Ziehl Nelsen Stain.

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1. Introduction

Tuberculosis (TB) is an ancient disease that has long been a major public health challenge in the world. It is caused by *Mycobacterium tuberculosis* and affects about 1/3rd of the world's population. Tuberculosis can lead to malnutrition, and malnutrition may predispose to tuberculosis. The micronutrient status in tuberculosis is affected significantly. Among the micronutrients, zinc plays a very important role as far as cell-mediated immunity is concerned. Many studies have revealed hypozincemia in active pulmonary tuberculosis. Zinc status in other forms of tuberculosis, e.g., central nervous system, abdominal TB, and tuberculous lymphadenitis (TBL), which commonly occurs in children, is not known much. The aim of the present study was to estimate serum zinc levels in children having different types of tuberculosis, and to compare them with children having malnutrition without tuberculosis. The aim was also to compare serum zinc levels in children with tuberculosis with and without malnutrition.

2. Materials and methods

The present study was conducted on 100 children in the age group of 6 months–12 years who reported to the Department of Pediatrics (Indoor and Outdoor) of Rajindra Hospital, Patiala, out of which 50 children were affected by tuberculosis (Group A) and 50 children were those with malnutrition without tuberculosis (Group B). 50 age- and sex-matched children were taken as control (Group C).

1. **Group A** – Children with tuberculosis (TB): It included 50 children with different forms of TB viz.
   Pulmonary TB
   Abdominal TB
   CNS TB
   TBL
2. **Group B** – Malnourished children: This group included 50 children with weight for age 80% or below and they were divided into different grades according to IAP classification. They were considered "TB free" by examining their gastric washing, chest X-ray, tuberculin skin test, and clinical findings.
3. **Group C** – Control group: 50 healthy children who had no history of TB and their clinical examinations did not demonstrate TB, malnutrition, or any other disease.

The controls in the study were matched for age and sex.

Children having chronic liver disease, non-tuberculous pulmonary infections, chronic renal failure, nephrotic syndrome, malabsorption syndrome, cystic fibrosis, congestive heart failure, diabetes mellitus, and who have tuberculosis that is already on treatment were excluded from the study. Serum zinc levels were estimated in each group.

Complete history, physical and relevant clinical examination was performed. Parameters such as age, sex, body weight, height, mid arm circumference, and nutritional details were recorded.

Diagnosis of tuberculosis was made on the basis of

1. Clinical examination and history
2. Investigations
(a) Investigations for the diagnosis of pulmonary tuberculosis
Chest X-ray
Mantoux test
ESR Wintrobe's method[1]
ZN staining of gastric washing for AFB for 3 consecutive days (out of 23 pulmonary TB cases 5 were AFB positive)
(b) Diagnosis of CNS tuberculosis
All the above and CSF analysis
(c) Diagnosis of tuberculosis lymphadenitis
All the above and FNAC of lymph node
(d) Diagnosis of abdominal TB
All the above and ultrasound abdomen
3. Special investigation:
Serum zinc levels[2]
Serum zinc estimation was done by END POINT Method using Semi Auto Analyser (ERBACHEM).

Serum zinc levels were estimated on newly diagnosed cases before the start of ATT and was not repeated after the ATT completion because our hospital is tertiary hospital and patients are referred to peripheral DOTS center for completion of ATT.

The data were analyzed using Student's *t*-test (95% confidence limits), chi-square test, and ANOVA where appropriate. *p*-value of less than 0.05 was considered significant.

3. Results

The results obtained from our study are summarized in the form of tables given in the subsequent headings.

Table 1 shows that children with TB had significantly lower serum zinc levels as compared to controls (p-value <0.0001).

Table 2 shows that all the different clinical types of TB had significantly lower serum zinc levels as compared to controls ($p < 0.0001$). But there was no statistically significant difference of serum zinc levels among the different types of TB when compared with each other ($p > 0.05$).

Table 1 – Comparison of serum zinc levels (μg/dl) between children with TB (Group A) and controls (Group C).

Group	No. of cases	Serum zinc levels		*p*-value	Significance
		Range (μg/dl)	Mean ± SD (μg/dl)		
Controls (Group C)	50	61–118	86.84 ± 15.92	<0.0001	Highly significant
Children with TB (Group A)	50	35–68	45.18 ± 10.05		
Total	100	35–118	66.01 ± 24.78		