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Community Medicine

Effect of Zinc on Growth Status in School going Thalassemic Children in a Tertiary Care Hospital at Kolkata

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Original Research Article

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Abstract: Most of the beta thalassemia patients are associated with impaired growth status particularly patients having regular blood transfusion.We have selected 51 school going children of ß thallassemic major and 53 control subjects(Age and sex matched) and measured their age, height, weight and serum zinc concentrations and compared them. Significant decrease of height, weight and serum zinc concentrations were found in thallassemic children. Furthermore, the growth status was positively correlated with serum zinc concentrations in thallassemic children. Zn supplementation in them can improve the growth status as well as cognitive development.
Keywords: β thalassemia, school going children, (S) zinc, growth status.

INTRODUCTION

Thalassemia is one of the most common hereditary haematological disorders [1]. The incidence and prevalence of thalassemia are prevalent in populations of humid climates particularly where malaria was prevalent. The prevalence of thalassemia was estimated as 3-8% in Bangladesh, China, India, Malayasia ans Pakistan [2].

Zinc (Zn) is an essential trace element required for skeletal growth and development [3]. Clinical zinc deficiency is prevalent in India particularly in malnourished children suffering from chronic diseases [4]. Furthermore, zinc is an essential trace element for many enzymes involved in cell divisions, DNA replications, metabolism and protein synthesis [5].

Zinc deficiency is associated with clinical manifestations like growth retardation, delayed wound healing, impaired glucose tolerance and hypogonadism. Furthermore it is associated with anaemia and decreased leucocyte count. Thalassemia major in young patients not receiving blood transfusion were observed decreased zinc levels [6]. Iron chelation therapy with desferrioxamines given to thalassemia patients were also reported to low zinc values as well as increased zinc excretion [7].

Some authors also documented that zinc deficiency aggravates anaemia [8]. Besides a trace element, zinc plays a significant role in gene expression by forming Zinc Finger Protein (ZFP). ZFP can help in interaction with small protein with DNA by forming a loop, thereby forms DNA protein and Protein-Protein interactions, thus helps in gene expression by regulating transcriptional factors [9,10].

Zinc status in thalassemia major patients has been under debate. Since the load of thalassemia patients particularly in younger age group of school going age is increasing day by day at our region, we have arranged the study to evaluate the zinc level and growth status in them so that the zinc supplements at this stage may be beneficial for them and may improve their quality of life.

MATERIALS AND METHODS

Study design

This hospital based, cross sectional, non-interventional study was conducted during the period of November 2017 to April 2018 in the Thallassemia clinic and Department of Biochemistry, Calcutta National Medical College, Kolkata, West Bengal, India.

Ethical permission

The study was approved by Institutional Ethics Committee (IEC), according to Helsinki declaration. Written informed consents were taken from study subjects.

Selection of study group

The Case group (Group 2) included 51(Fifty one) diagnosed patients of beta thalassemia, age ranging between 6-16 years attending thalassemia clinic of Calcutta National Medical College. Diagnosis was based on peripheral smear and High Performance Liquid Chromatography (HPLC). 53(Fifty three) age, sex matched and same socio-economic status like case group control subjects (Group 1) has been selected from normal healthy childs without family history of thalassemia or hemoglobinopathies.

Sample Collection

150 to 200 microlitre of residual blood was collected from the routine sample (blood) taken from thallassemic children at thallassemia clinics on convenience basis in clot vial.

Sample Preparation

Serum has been separated for zinc estimation; Serum was stored at -20 degree.

Exclusion criteria

Underlying medical condition other than thalassemia, associated medical conditions like Protein Energy Malnutrition (PEM), congenital cardiac disease, bronchial asthma, neurological disorders and haemoglobinopathies, children taking any dietary supplement containing zinc during the last month.Patients who are febrile (oral temperature >38°C) or was acute infection based on physical examination at the time of blood sampling also excluded since zinc level decreases in febrile illness.

Methods for test parameters

Height and weight were measured by standard measuring tape and weight machine. Values were compared with stature for age and height for age percentile chart (CDC)

Lab procedure

Serum zinc estimation

Serum zinc was measured by colorimetric method (Crest Biosystems).

Principle

Zinc in alkaline medium reacts with nitro-Paps to form a purple coloured complex. Intensity of the complex formed is directly proportional to the amount of zinc present in the sample.

Instrument used - Spectrophotometer.

Ethical permission

The study was approved by Institutional ethics committee. Written consent has been taken from the patient.

Statistical methods used

Statistical analysis was done by computer software SPSS Version 17 and results were analyzed. Unpaired t test and correlation coefficient linear regression plot were performed, p value was considered significant when <0.05.

Data collection and processing for statistical analysis

Statistical analysis was aimed

- To assess the significance of difference between the mean values of height, weight and (S) zinc levels between case and control groups.
- To find out any correlations between growth status and (S) zinc levels between the same groups.

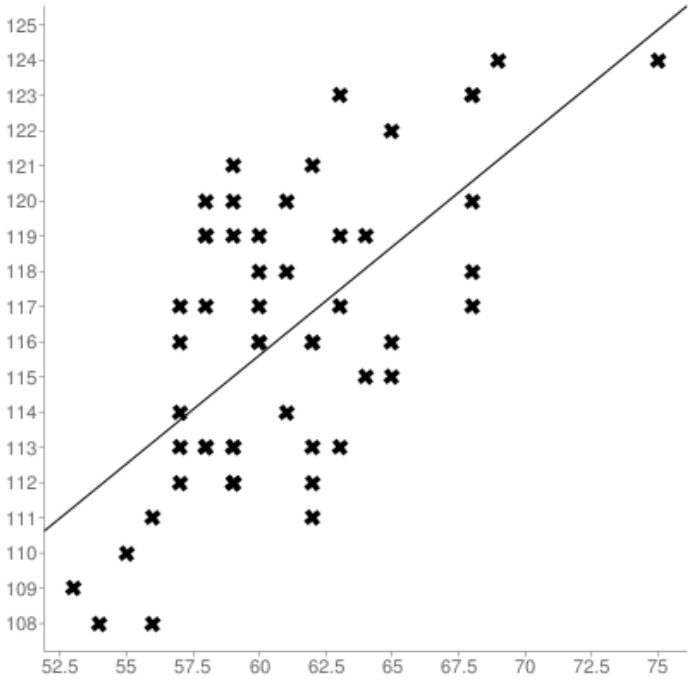
OBSERVATION AND RESULTS

Table-1: Group statistics

	Grouping	N	Mean	SD	SEM	
Age In yrs	Gr- 1	53	8.27	1.14	0.15	
	Gr- 2	51	8.14	1.30	0.14	
Height In cms	Gr- 1	53	121.8	5.1	0.72	
	Gr- 2	51	118.8	5.4	0.74	*
Weight In kg	Gr-1	53	24.27	2.6	0.36	
	Gr-2	51	22.70	3.2	0.44	*
Zn in mg/dL	Gr-1	53	92	14.7	2.0	
	Gr- 2	51	63.02	12.1	1.6	*

Table 1 showing the number (N), mean values, standard deviations (SD), standard errors of mean (SEM) of the parameters in group 1 (Controls) and group 2 (Cases). Unpaired t test was done to compare them. * indicates when p value is significant. (p<0.05)

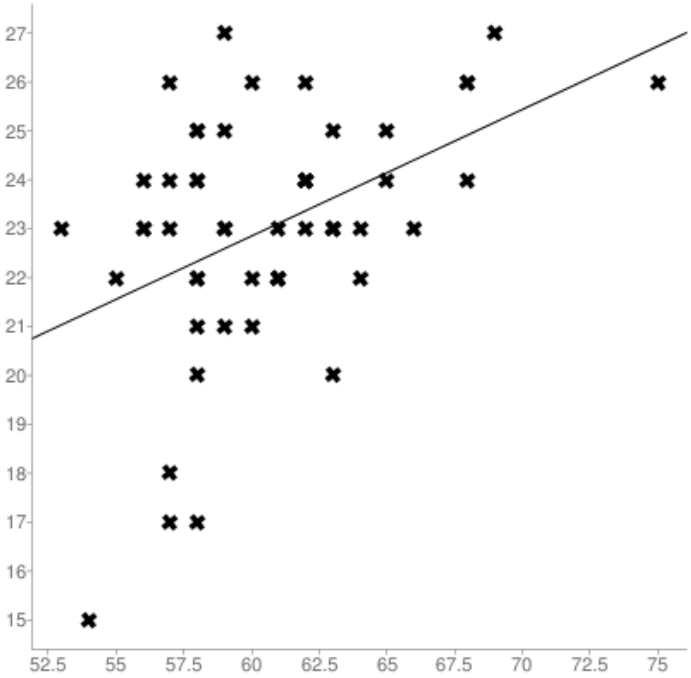
Height in cms



(S) Zinc in mg/dL

Fig-1: Correlation studies between (S) zinc level and height among thalassemia children.

Weight in kgs



(S) Zinc in mg/dL

Fig-2: Correlation studies between (S) zinc levels and weight among thalassemia children

From the above table and figures, we can summarize the results

- Mean age in years are not significantly different between two groups.(p=0.58)

- Mean height (in cms) of thallassemic patients are significantly shorter than controls (p=0.0045)
- Mean weight (in kgs) of thallassemic patients are significantly lower than controls (p=0.01)
- Mean serum zinc levels are significantly decreased in thallassemic patients when compared to controls (p<0.0001)
- Serum zinc level of case group is positively correlated with height and weight.

DISCUSSION

Results of our study have clearly shown that there are no significant differences in mean ages between control and thallassemic patients, proving that control subjects are age matched with cases. Significant differences were found in height,weight and serum zinc concentrations between control and case groups. We found significant reduction of height, weight and serum zinc concentrations in thalassemic school going children than controls (Table 1).Furthermore, positive correlation was observed between serum zinc level and growth status (height and weight) in thalassemic children (Figure 1 and 2).

Thallassemia major is a severe form of ß thallassemia and patients need repeated blood transfusions with chelation therapy to continue their lives.Those patients are subjected to a variety of complications like growth impairment, endocrinopathies and hypogonadism.Zinc is one of the essential micronutrients in human preceded by iron. It acts as a cofactor of more than 300 enzymes. Zn deficiency leads to severe clinical disorders including growth impairment, hypogonadism, immunological disorders, and repeated infections [3].

Present study has shown the growth impairment in the form of height and weight reduction.Zn deficiency may contribute the growth reduction. Some authors observed reduced serum Zn in ß thallassemia major patients [11].

Failure of physical growth in ß thallassemia may result from chronic anaemia, folate deficiency, hypersplenism, hypothyroidism, Growth Hormone deficiency, iron overload, desferrioxamine toxicity and Zn deficiency [3].

The present study found significant decrease of serum Zn concentrations in school going thallassemic children. Tabatubei *et al*. reported 84.8% of the ß thallassemia major patients are suffering from Zn deficiency [12]. Cause of Zn deficiency in thalassemia patients may be due to insufficient dietary intake, abnormality in urinary absorption, renal failure, and hyperzincuria [13].Some authors explained the role of insulin like growth factor 1 and Growth Hormone in growth inhibition induced by magnesium and zinc deficiencies [14]. Hyperzincuria in these patients has been postulated as a probable cause of delayed linear growth in these patients [15].Furthermore zinc deficiency may affect the transcriptional factors[9,10].

Since the quality of life in these patients is an important aim, it is vital to monitor carefully the growth and pubertal development in order to to detect abnormalities and initiate appropriate early treatment.Short stature and hypogonadism are extremely frequent in thallassemia, but correct blood transfusion and appropriate iron chelation therapy can prevent growth delay [16]. Faranaush M *et al*. has shown the Zn supplementation effect on linear growth in ß thalassemia [15].

From the findings of present and previous studies we can indicate that the Zn deficiency is a growth limiting factor in school going ß thallassemia major patients. We suggest Zn supplement in them to maintain their cognitive and academic performance.

CONCLUSION

Growth impairment and serum Zinc deficiency in school going ß thalassemia major children were observed in our study. Zn supplement can improve the growth status and other abnormalities related to Zn deficiency. Estimation of Zn is easy, cheap and quick process can be done in all laboratories. Measurement of height, weight and serum Zn estimation may be recommended for school going thalassemia children.

There is a need for broader study for deeper insight into the topic. Awareness and counselling programme for school going thalassemia children are also required to improve the quality of life.

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