

Original Research Article

Oral Intake and Association of Serum Zinc Level with Febrile Seizures in Children

Abstract

Introduction: Febrile seizures occur in common childhood infections such as infections of the respiratory system, otitis media, acute gastroenteritis, and children respond to these infections with comparably higher temperatures. **Aims and objectives:** The basic aim of the study is to analyze the intake and oral association of serum zinc level with febrile seizures in children of Pakistan. **Material and methods:** This study was conducted at Allied hospital, Faisalabad during May 2018 to June 2018. The children of 1 year to 7 years were considered in this study. 5cc blood was collected by venipuncture under strict aseptic precautions and sent to biochemistry laboratory for assessment of serum zinc levels. Determination of serum zinc levels was done by calorimetric method. **Results:** Frequency of low serum zinc level was 26% in children with febrile seizures. Sixty three (63%) children were between 6 months to 3 years of age while rest of the 37(37%) were between >3 years to 6 years of age. Low serum zinc level in different age groups is given in table 01. Upper respiratory tract infection was the most frequent cause of fever evident in 24 children (24%) followed by tonsillitis 17 (17%), pneumonia 16 (16%), urinary tract infection 16 (16%), otitis media 15 (15%), and bronchiolitis 12 (12%) in children having febrile seizures. **Conclusion:** It is concluded that low serum zinc levels are fairly sufficient to support the hypothesis that Zinc deficiency could be a potential risk factor for febrile seizure in children.

Introduction

Febrile seizures occur in common childhood infections such as infections of the respiratory system, otitis media, acute gastroenteritis, and children respond to these infections with comparably higher temperatures. The onset of febrile seizures generally follows a bell-shaped curve. 94% occur within the first three years of age and 6% after three years of age¹.

A seizure is a paroxysmal event caused by abnormal electrical discharge inside the brain. Febrile convulsion; twice as common in boys as in girls, is one of the most common type of seizure occurring in children between 5 months and 6 years of age, accounting for 30% of all seizures in children. This is an age dependent response of the immature brain to fever in children, who do not have an intracranial infection, metabolic disturbance, or history of afebrile seizures². Eighty to eighty five percent febrile seizures occur between 6 months and 3 years of age, with peak incidence at 18 months. Children with a simple febrile seizure has potential for recurrence and 2-7% of children may develop epilepsy by adolescence. Contrary to simple febrile seizure, complex febrile seizures are prolonged (>15 minutes), focal and occur more than once in 24 hours³.

Zn is as a co-factor of glutamate decarboxylase which is an enzyme needed for gamma-aminobutyric acid synthesis in the central nervous system and reduced CSF zinc levels have also been noted in febrile convulsions. Recent evidences indicate that zinc deficiency plays a significant role in febrile seizures. The following mechanisms can be postulated. Zinc increases storage capacity of glutamate or slows down the release rate of glutamate⁴. Zinc increases the activity of pyridoxine needed for pyridoxine formation reciprocally pyridoxine increases the activity of glutamate decarboxylase which results in gamma-aminobutyric acid syntheses. Thus, decreased zinc levels lowers GABA synthesis which would precipitate seizures. Persistent and

prolonged seizure activity cause cerebral edema, hypoxia, hyperthermia, hypoglycemia and vasomotor instability⁵. Respiratory depression may ensue from involvement of respiratory centre or from drugs used for seizure control⁶.

Aims and objectives

The basic aim of the study is to analyze the intake and oral association of serum zinc level with febrile seizures in children of Pakistan.

Material and methods

This study was conducted at Allied hospital, Faisalabad during May 2018 to June 2018. The children of 1 year to 7 years were considered in this study.

Exclusion criteria

The patients who had any evidence of central nervous system infection, epilepsy, metabolic seizures or those who are already on zinc therapy for any other ailment like malnutrition, diarrhea, pneumonia or acrodermatitis enteropathica were excluded.

Determination of Zinc levels

The data was collected from 100 patients of both genders. 5cc blood was collected by venipuncture under strict aseptic precautions and sent to biochemistry laboratory for assessment of serum zinc levels. Determination of serum zinc levels was done by calorimetric method. The principle being zinc in alkaline medium reacts with nitro PAPS to give a purple color change. The intensity of the color formed depends in a direct relation to the levels of zinc found in the sample. Though earlier studies have established a linear relationship between serum zinc and CSF zinc in children with febrile seizures, CSF zinc analysis was not done in our study.

Statistical Analysis

The data was entered through a trained computer operator and imported into statistical package for social sciences (SPSS) version 17 for statistical analysis. Frequency distribution tables were produced with percentages.

Results

Frequency of low serum zinc level was 26% in children with febrile seizures. Sixty three (63%) children were between 6 months to 3 years of age while rest of the 37(37%) were between >3 years to 6 years of age. Low serum zinc level in different age groups is given in table 01. Upper respiratory tract infection was the most frequent cause of fever evident in 24 children (24%) followed by tonsillitis 17 (17%), pneumonia 16 (16%), urinary tract infection 16 (16%), otitis media 15 (15%), and bronchiolitis 12 (12%) in children having febrile seizures (table 2).

Table 01: Low Serum Zinc Level in Febrile Seizure Patients in Relation to Age Groups

Age in years	No. of Patients with Low Serum Zinc	No. of Patients	Percentage (%)
Total	10	20	50
1 – 3	6	15	23.8
3-5	20	9	45
5-6	09	2	27
>6	37	11	29.7

Table 02: Low Serum Zinc Level in Febrile Seizure Patients with Relation to Causes of Fever

Causes	Total No. of Patients	No. of Patients with Low Serum Zinc	Percentage (%)
Total	100	26	
Upper respiratory tract	24	6	25.0

infection			
Tonsillitis	17	5	29.4
Pneumonia	16	5	31.3
Urinary tract infection	16	5	31.3
Otitis media	15	3	20.0
Bronchiolitis	12	2	16.7

Discussion

Febrile seizure is a common neurologic problem occurring in children aged between 6 months to 6 years. The etiology of febrile seizure is unknown but genetic factors or electrolyte disturbances may have a role in its occurrence or recurrence. To date, it is revealed that febrile seizures can be induced by several factors⁷. There is a hypothesis that febrile seizures arise due to excitation of the neurons during brain growth. This correlates with the most common age group in which this entity occurs. Gamma-aminobutyric acid is an important inhibitory neurotransmitter⁸.

Although its pathogenesis is debatable, studies have revealed that the genetic factors, family background, immunologic disorders, iron deficiency and zinc deficiency may play a role in febrile seizure. The infection state exhibits non-specific host responses, including immune responses such as changes in the concentrations of certain plasma proteins, cytokines (tumor necrosis factor, interleukin-1, interleukin-6) and interferon which may result in reduction of serum zinc level. Hypozincemia has been suggested as a possible change during the rising phase of body temperature in febrile patients⁹. Ganesh et al from Chennai, Lee et al, and Hitz et al also showed similar results. The serum zinc levels did not show any significant correlation with age of onset, gender, family history and nutritional status in this present study¹⁰.

Conclusion

It is concluded that low serum zinc levels are fairly sufficient to support the hypothesis that Zinc deficiency could be a potential risk factor for febrile seizure in children.

References

1. Talebian A, Vakili Z, Talar SA, Kazerni M, Mousavi GA. Assessment of the relation between serum Zinc and magnesium levels in children with febrile convulsion. *Iranian J Pathol.* 2009;4:157-60.
2. Vestergaard M, Obel C, Henriksen TB, Christensen J, Madsen KM, Ostergaard JR. The Danish National Hospital Register is a valuable study base for epidemiologic research in febrile seizures. *J Clin Epidemiol.* 2006;59:61–66.
3. Jensen FE, Sanchez RM. Why does the developing brain demonstrate heightened susceptibility to febrile and other provoked seizures. In: Baram TZ, Shinnar S, editors. *Febrile seizures.* San Diego: Academic Press; 2002. pp. 153–168.
4. Bhandari N, Bahl R, Taneja S, Strand T, Molbak K, Ulvik RJ, et al. Effect of routine zinc supplementation on pneumonia in children aged 6 months to 3 years: randomised controlled trial in an urban slum. *BMJ.* 2002;324(7350):1358–1359.
5. Mollah MA, Rakshit SC, Anwar KS, Arslan MI, Saha N, Ahmed S. Zinc concentration in serum and cerebrospinal fluid simultaneously decrease in children with febrile seizure: findings from a prospective study in Bangladesh. *Acta Paediatr.* 2008;97:1707–1711.
6. Raqib R, Roy SK, Rahman MJ, Azim T, Ameer SS, Chisti J. Effect of zinc supplementation on immune and inflammatory responses in pediatric patients with shigellosis. *Am J Clin Nutr.* 2004;79:444–450.

7. Modarresi MR, Shahkarami SMA, Yaghini O, Shahbi J, Mosaiebi D, Mahmoodian T. The relationship between zinc deficiency and febrile convulsion in Isfahan, Iran. *Iranian J Child Neurol*. 2011;27–31.
8. Talebian A, Vakili Z, Talar SA, Kazemi SM, Mousavi GA. Assessment of the relation between serum zinc & magnesium levels in children with febrile convulsion. *Iranian J Pathol*. 2009;4:157–160.
9. Garty BZ, Olomucki R, Lerman-Sagie T, Nitzan M. Cerebrospinal fluid zinc concentrations in febrile convulsions. *Arch Dis Child*. 1995;73:338–341.
10. Hauser WA. Prevalence and incidence of convulsive disorders in children. *Epilepsia*. 1994;35(2):s1-6.