

## Original Research Article

# A study of serum zinc levels among children with seizures in comparison with febrile children without seizures

Pranam G. M., Usha Hirevenkanagoudar\*, Sanjeev Chetty

Department of Pediatrics, Navodaya Medical College, Raichur, Karnataka, India

**Received:** 05 February 2020

**Accepted:** 10 February 2020

**\*Correspondence:**

Dr. Usha Hirevenkanagoudar,

E-mail: [Statisticsclinic2018@gmail.com](mailto:Statisticsclinic2018@gmail.com)

**Copyright:** © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

### ABSTRACT

**Background:** Infants and children are more prone to have seizures than adults. This reflects the greater neuronal excitability at certain ages as the excitatory glutamate system and inhibitory GABA system do not always balance each other. Febrile seizures are the most common type of seizures observed in pediatric age group. Febrile seizures occur in young children at a time in their development when seizure threshold is low. Objective of the study was to determine the levels of zinc in children with febrile seizures when compared to children with fever without seizures.

**Methods:** To determine the levels of zinc in children with febrile seizures when compared to children with fever without seizures. A total of 50 Study subjects were selected into each group. Group 1: Children with Febrile Seizures. Group 2: Children with Fever and Without Febrile Seizures.

**Results:** Among the cases with fever and convulsion Zinc level was found to be low among 72% of the subjects, 22 % of them had normal zinc levels and only 6% had high zinc levels. Among the subjects with Fever and no convulsions nearly 80% of them had normal zinc levels, 16 % had low levels of zinc and 4% had high zinc levels. The association of levels of Zinc between both the groups was found to be statistically significant.

**Conclusions:** This study shows that serum zinc levels are decreased in children with febrile convulsions when compared to children with fever alone without convulsions, thus indicating that zinc deprivation plays significant role in the pathogenesis of febrile convulsions.

**Keywords:** Children, Convulsion, Febrile, Newborn, Zinc

### INTRODUCTION

Epilepsy is one of the most common disorders of the brain. One of every ten people will have at least one epileptic seizure during a normal lifespan, and a third of these will develop epilepsy. Worldwide, epilepsy affects 50 million people. According to a World Health Organization (WHO) survey, epilepsy accounts for 1% of the global burden of disease, a figure equivalent to breast cancer in women and lung cancer in men.<sup>1-3</sup>

Infants and children are more prone to have seizures than adults. This reflects the greater neuronal excitability at certain ages as the excitatory glutamate system and

inhibitory GABA system do not always balance each other. This results in a tendency to exhibit symptomatic seizures related to high fever, infections, minor asphyxia, medications, bacterial toxins and biochemical disturbances like hyponatremia, hypernatremia, hypocalcemia etc.<sup>4</sup>

Febrile seizures are the most common type of seizures observed in pediatric age group. Febrile seizures are defined as an event in infancy or childhood usually occurring between six months to six years of age associated with fever but without evidence of intracranial infection or defined cause.<sup>5</sup>

Febrile seizures occur in young children at a time in their development when seizure threshold is low. They typically occur relatively early in an infectious illness usually during the raise of temperature curve. Febrile seizures occur in common childhood infections such as upper respiratory tract infection, lower respiratory tract infection, otitis media, acute gastroenteritis, and children respond to these infections with comparably higher temperatures.

A number of trace elements are said to play a role in febrile convulsions by their co-enzyme activity or ability to influence ion channels and receptors. Studies have shown that iron, zinc, selenium, copper and magnesium play a significant role in febrile convulsions.<sup>6</sup>

Zinc (Zn) acts as a co-factor of glutamic acid decarboxylase, an enzyme which maintains the production of GABA in central nervous system and decreased level of Zn in CSF has also been observed in febrile seizures. In CNS zinc acts as neurosecretory product or co - factor. Zinc is highly concentrated in the synaptic vesicles of a specific contingent of neurons called zinc containing neurons.

Recent evidences indicate that deficiency of zinc can play significant role in febrile seizures. Therefore, with regard to importance of febrile seizure and its possible contributing factors including serum zinc level this study is been conducted to compare the serum zinc levels in children with febrile seizures in comparison with febrile children without seizures.<sup>7</sup>

Objective of the study was to determine the levels of zinc in children with febrile seizures when compared to children with fever without seizures.

## METHODS

A Cross sectional study was conducted by the Department of Pediatrics at Navodaya Medical College, Raichur, Karnataka from January 2019 to June 2019. A total of 50 Study subjects were selected into each group.

- Group 1: Children with febrile seizures.
- Group 2: Children with Fever and Without Febrile Seizures.

### Inclusion criteria

- Children aged 6 months to 6 years with febrile seizures.
- Children aged 6 months to 6 years with fever without seizure.

### Exclusion criteria

- Cerebral palsy

- Seizure disorder
- Chronic diseases
- Dysmorphic and syndromic features
- Children on zinc supplements
- Children on anticonvulsants.

Informed consent of parents of three groups of children was obtained in a printed consent form. Any questions or doubts were cleared and signature of parent was obtained. The study protocol was approved by the ethics committee of our hospital.

Prior to inclusion of the children in the study, a detailed history of presenting complaints was recorded by our history included duration of fever, time of onset of seizures, type of seizures, duration of seizures, past and family history of seizures. In addition, history suggestive of any triggering factors for febrile episode like cough, cold, nasal discharge, ear discharge, burning micturition or crying during micturition were also recorded.

## RESULTS

A total of 100 study subjects were selected and 50 of them were included into each group.

In the present study majority of the subjects were less than 3 years of age in both the groups. Nearly 56% of the cases with convulsion and 48% cases without convulsion were less than 3 years of age in our study. In both the groups 56% among cases with convulsion and 60% among cases without convulsion were found to be male. Majority (70%) of the subjects with convulsion and 64% of them without convulsion were from Rural areas. Nearly 86% of the cases with convulsion and 80 % of them without convulsion had no positive history of convulsion among the family members. All the variables were found to be statistically insignificant (Table 1).

The Zinc levels of all the cases in both the groups was measured. Among the cases with fever and convulsion Zinc level was found to be low among 72% of the subjects, 22 % of them had normal zinc levels and only 6% had high zinc levels. Among the subjects with Fever and no convulsions nearly 80% of them had normal zinc levels, 16 % had low levels of zinc and 4% had high zinc levels. The association of levels of Zinc between both the groups was found to be statistically significant.

The mean level of Zinc was found to be 50.2 among subjects with convulsion and 87.6 among subjects without convulsion and the difference of them between both the group was found to be statistically significant. Though the levels of Zinc were found to be statistically significant the average temperature recorded among the subjects in both the groups was found to be statistically insignificant (Table 2).

**Table 1: Socio Demographic profile of the study subjects.**

Social profile		Children with febrile convulsions (n=50)		Children with fever and without seizures (n=50)		p value
		N	%	N	%	
Age group	<2 Years	28	56	24	48	Chi Square = 2.78 p=0.595
	2-3 Years	12	24	10	20	
	3-4 Years	5	10	6	12	
	4-5 Years	4	8	6	12	
	5-6 Years	1	2	4	8	
Gender	Male	28	56	30	60	Chi Square = 0.164 p=0.685
	Female	22	44	20	40	
Place	Rural	35	70	32	64	Chi Square = 0.407 p=0.523
	Urban	15	30	18	36	
SES	1	3	9	4	8	Chi Square = 1.15 p=0.886
	2	10	20	8	16	
	3	12	24	16	32	
	4	20	40	18	36	
	5	5	10	4	8	
Family history	Yes	7	14	10	20	Chi Square = 0.638 p=0.424
	No	43	86	40	80	

**Table 2: Comparison of Zinc level and clinical among both the groups.**

Zinc levels		Children with febrile convulsions (n=50)		Children with fever and without seizures (n=50)		p value
		N	%	N	%	
Zinc levels	Low	36	72	8	16	Chi Square = 34.5 p=0.0001
	Normal	11	22	40	80	
	High	3	6	2	4	
Mean Zinc level		50.2±21.5		87.6±17.9		T test = 9.45 p=0.0001
Mean temperature		101.6±1.2		101.7±1.3		T test =0.397 p=0.250

## DISCUSSION

The cause of febrile seizure among the children is unknown but few of the research articles gives the onus on the genetic factors, electrolyte imbalance or deficiency of any of the nutritive value among the children. The enhanced neuronal excitability during the time of seizure can be modulated by the effect of Gamma amino butyric acid which acts an important inhibitory neurotransmitter. Zinc has a regulatory effect on glutamic acid decarboxylase and the synthesis of GABA. Hence the levels of the Zinc in the children is also related to occurrence of Seizure among children.

Majority of the febrile children with or without convulsion were aged less than 3 years. In the study done by Lynette et al, the mean age of the children with fever was found to be 18 months, Samir S et al, the mean age of children was found to be 20 months.<sup>8,9</sup> The gender predominance among study was seen more among Male than female and the similar observations were made in the study done by Hartfield et al, and Leelakumari et al.<sup>10,11</sup>

The incidence of Seizure among the family members was seen in 20% of the subjects with convulsion. Similarly, Soidal Haque et al, found positive family history in 20% of the subjects and Farwell et al, found positive family history in 29% of the cases.<sup>12,13</sup>

The mean serum zinc levels were found to be much lesser among the subjects who had convulsion when compared to the children without convulsion. The serum Zinc Level was found to be low in Majority of the subjects with convulsions when compared to subjects without convulsion.

The findings of this study was comparable to the study findings of Mollah MA et al, where serum and CSF Zinc Level was lower among children with convulsion when compared to the children without convulsion.<sup>14</sup> Knudsen FU et al, also found that the mean serum zinc level was significantly lower in cases of Febrile convulsion when compared to children without convulsion.<sup>15</sup> Amiri M et al, Hydarain F et al, also found similar findings which is comparable to the study findings.<sup>16,17</sup>

Garty BZ et al, opined that the occurrence of febrile convulsions is not related to the level of Zinc concentration.<sup>18</sup>

## CONCLUSION

This study shows that serum zinc levels are decreased in children with febrile convulsions when compared to children with fever alone without convulsions, thus indicating that zinc deprivation plays significant role in the pathogenesis of febrile convulsions.

The role of zinc in febrile convulsions should be investigated by further studies and if the results are reproducible, zinc supplementation can be given in febrile convulsions.

However, considering the fact that zinc has multiple beneficial roles in body system, zinc supplementation may still serve as a cost effective measure for prevention of febrile convulsions in the susceptible age group.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee*

## REFERENCES

1. Temkin O. The Falling Sickness. Baltimore: Johns Hopkins Press; 1945:380.
2. World Health Organization. Atlas: Epilepsy Care in the World. Geneva: World Health Organization; 2005:91.
3. Johnston MV. Seizure in childhood: febrile seizure. 19th ed. In: Nelson's textbook of pediatrics. Behrman RE, Kliegman RM, Stanton, eds. Pennsylvania: Saunders; 2004:2013-2014.
4. Dravet C, Bureau M, Oguni H. Severe myoclonic epilepsy in infancy (Dravet syndrome). In: Epileptic Syndromes in Infancy, Childhood and Adolescence. Roger J, Bureau M, Dravet C, Genton P, Tassinari CA, Wolf P, eds. 3rd ed. Eastleigh, UK: John Libbey & Co Ltd; 2002:81-103.
5. American Academy of Pediatrics. Febrile Seizures: Long-Term Management of Children with Fever-Associated Seizures. Pediatr. 1980 Dec 1;66(6):1009-12.
6. Patrylo PR, Spencer DD, Williamson A. GABA uptake and heterotransport are impaired in the dentate gyrus of epileptic rats and humans with temporal lobe sclerosis. J Neurophysiol. 2001;85:1533-42.
7. National Research Council. Recommended dietary allowances. National Academies Press; 1989 Feb 1:205-13.
8. Lynette, Sadhir, Ingrid, Scheffer. Age of Onset of febrile Seizures. BMJ. 2007;334:307-11.
9. Samir S, Elizabeth A, Zwerlinglisa Z, Jennifer R, Louis H. Low risk bacteremia in children with febrile seizures. Arch Pediatr Adolesc Med. 2002;156:469-72.
10. Hartifeld DS, Tan J, Yager JY, Rosychuk RJ, Spandy D, Haines C, et al. The association between iron deficiency and FS in childhood. Clinical Pediatr. 2009; 48(4):420-6.
11. Kumari PL, Nair MK, Nair SM, Kailas L, Geetha S. Iron deficiency as a risk factor for simple febrile seizures-a case control study. Indian Pediatr. 2012 Jan 1;49(1):17-9.
12. Haque S. Febrile convulsions- a study. Pak Pediatr J. 1981;5(3):15-55.
13. Farewell JR, Blackwell G, Sulzbacker S, Adelman L. First febrile seizures. Characteristics of the child, the seizure and the illness. Clinical Paediatric Phila. 1994;33(5):263-7.
14. Mollah MA, Dey PR, Tarafdar SA, Akhter S, Ahmed S, Hassan T, et al. Zinc in CSF of patients with febrile convulsion. Ind J Pediatr. 2002 Oct 1;69(10):859-61.
15. Knudsen FU. Practical management approaches to simple and complex febrile seizures. In: Baram TZ, Shinnar S, editors. Febrile Seizures. San Diego, CA: Academic Press; 2002:274-304.
16. Amiiri M, Farzin L, Moassesi ME, Sajadi F. Serum trace element levels in febrile convulsion. Biol Trace Elem Res. 2010;135:38-44.
17. Farhad H, Farah AZ, Ahmed G. Serum zinc level in febrile seizures. Iran J Child Neurol. 2010;4(2):129-32.
18. Garty BZ, Olomucki R, Lerman-Sagie T, Nitzan M. Cerebrospinal fluid zinc concentrations in febrile convulsions. Arch Dis Child. 1995;73:338-41.

**Cite this article as:** Pranam GM, Hirevenkanagoudar U, Chetty S. A study of serum zinc levels among children with seizures in comparison with febrile children without seizures. Int J Contemp Pediatr 2020;7:876-9.