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Serum Level of Zinc in Children with Febrile Seizures

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ABSTRACT

Objective: Febrile seizure is the most common pediatric population, usually occurring between six months to five years of age, which typically manifests during febrile illness. While the exact pathophysiology remains unclear, several factors are implicated, including genetic predisposition and variations in electrolyte levels such as zinc. In this study, we evaluated zinc level in children with the first FS attack and febrile children without seizure.

Materials and Methodology: This is a prospective study conducted among 30 patients with febrile seizure and 30 patient who are febrile without seizure. The children are within the age group of 6 months to 5 years. Serum zinc levels were measured by atomic absorption spectroscopy in these group.

Conclusion: Based on the present results, serum zinc level was lower in children with febrile seizures. However, further research is needed to examine the efficacy of zinc supplementation in prevention of febrile seizure.

Keywords: *Febrile seizure, Serum Zinc, Children*

1. INTRODUCTION

Febrile seizure is the most common occurrence in young children, often triggered by fever [1]. This usually occurs between six months to five years of age [2]. The primary mechanism underlying the pathophysiology of febrile seizures remain unclear. Genetic factors are known to play a major role in the occurrence of febrile seizures [3]. However, environmental factors, such as trace elements like zinc, might also influence the link between genetic variations and the onset of febrile seizures [3].

Zinc is a crucial trace element that supports growth and development, neurological function, nerve impulse transmission, and hormone release. It also stimulates the activity of pyridoxal kinase, an enzyme that regulates the level of gamma aminobutyric acid (GABA) [4].

In this prospective study, we assessed zinc levels in children experiencing their first febrile seizure and compared them to febrile children without seizures.

MATERIALS AND METHODOLOGY

This is a prospective study conducted in the Department of Pediatrics in hospitalized children between the age group of 6 months to 5 years during the period of July 2023 to December 2023. The study was designed to have two groups – children with first episode of febrile seizure and febrile children without seizure. The exclusion criteria include children with history of seizure, being younger than 6 months or older than 6 years, on zinc supplementation, having a history of febrile seizure, electrolyte disorder disorder, structural brain damage, failure to thrive or acute meningitis.

Samples were collected by taking one ml of blood sample from all children at first 6 hours of admission. Serum zinc levels were measured by atomic absorption spectrophotometry method. The normal range of zinc in the serum was 60-110 µg/dL, and zinc levels less than 40mcgs/dl were indicative of zinc deficiency. Statistical analysis was made using SPSS 23and the data is analyzed.

2. RESULTS

The study included 60 patients who were divided into two groups: group A, those with febrile seizure (n = 30) and group B, those who are febrile without seizure (control group = 30). Among the children in group A, 18 children were male (60%) and 12 children were female (40%). In group B, 17 children were male (56.6%) and 13 children were female (43.3%).

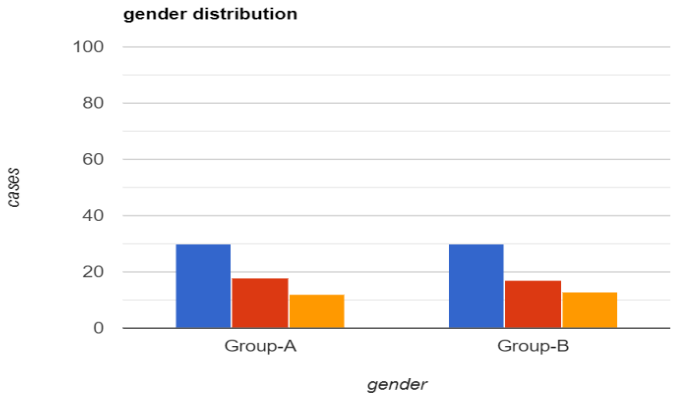

Figure 1: Gender distribution

The study includes children between the age group of 6 months to 5 years. The mean age of the children in the febrile seizure group is 2.8 ± 1.4 years and in the control group is 2.7 ± 1.3 years respectively.

The mean zinc level in group A is 62.1 ± 12.9 µg/dL and in group B is 86.3 ± 11.4 µg/dL. A significant difference in serum zinc levels was observed between children with febrile convulsions and healthy controls ($p < 0.001$). This results show serum zinc level in patients with febrile seizure was lower than that of febrile children without seizure.

Table 1: Presence of Zinc Deficiency

ZINC LEVEL	GROUP	A	GROUP	B
	NO	%	NO	%
<65 µg/Dl	20	66	8	26
>65 µg/dL	10	33	22	73
TOTAL	30		30	

The table above shows the presence of zinc deficiency among both the groups, with 66% in group A those with febrile seizures and 8% in group B, those who are febrile without seizures.

3. DISCUSSION

Febrile seizures (FS) are the most common type of seizures in children globally, typically affecting those between six months and five years of age. The main pathogenesis of FS remains unclear, though certain factors are believed to play a significant role in children with a genetic predisposition to FS [5].

Zinc plays a crucial role in growth, development, and normal brain function. It serves as an essential cofactor for various enzymes, contributing to cellular growth, differentiation, enzymatic activities in different organs, proteins, and cellular metabolism. In the brain, zinc is found in synaptic vesicles within a subset of glutaminergic neurons. When released through electrical stimulation, zinc can modulate responses at receptor levels, including both excitatory and inhibitory receptors, particularly N-Methyl-D-aspartate (NMDA) and Gamma-aminobutyric acid (GABA) receptors [6,7].

Zinc is known to be a cofactor for glutamic acid decarboxylase, an enzyme that modulates the production of gamma-aminobutyric acid (GABA) in the central nervous system (CNS). This regulates the activity of glutamic acid decarboxylase, the rate-limiting enzyme in GABA synthesis. Additionally, zinc enhances the affinity of neurotransmitters like glutamate for their receptors and facilitates the inhibitory effect of calcium on NMDA receptors [7,8].

In our study, among the children in group A, 18 children were male (60%) and 12 children were female (40%). In group B, 17 children were male (56.6%) and 13 children were female (43.3%), thereby showing a slight preponderance to male. This is consistent to the findings in studies like Ganesh et al., Margaretha at al [9,10].

Our investigation showed serum zinc level in patients with febrile seizure was lower than that of febrile children without seizure. This finding are similar to other studies like Heydarian et al., Ehsanipour et al. [11,12]. Other studies like Ganesh et al. showed serum zinc levels are lower in children with febrile seizure than in those with epileptic seizures and normal children [13].

The findings align with existing literature suggesting that adequate zinc levels are essential for maintaining normal neurological function and preventing seizures. Zinc's involvement in neurotransmitter function, neuronal excitability, and immune response highlights its critical role in brain health.

4. CONCLUSION

This study highlights a significant association between low serum zinc levels and febrile seizures in children. The findings support the potential role of zinc in seizure prevention and underscore the importance of maintaining adequate zinc levels for neurological health. Further research is warranted to confirm these findings and to explore the therapeutic potential of zinc supplementation in preventing febrile seizures.

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