

# Assessing the Association of Zinc Level in Children with Simple Febrile Seizures

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## Abstract

**Introduction:** Febrile convulsions are the most common type of seizure in children. A febrile seizure is an event in infancy and early childhood, usually occurring between 6 months and 5 years of age, associated with fever but without the evidence of intracranial infection or defined cause.

**Aim:** This study aims to study the association of zinc level with simple febrile seizures.

**Materials and Methods:** This observational study was conducted in the Department of Paediatrics, Government Headquarters Hospital, Dindigul, from January 2019 to June 2019 in 6 months to 5 years. Children were admitted to the pediatric intensive care unit with simple febrile seizures. Serum zinc level was estimated along with other investigations at the time of admission.

**Results:** In this study, 50 children from 6 to 60 months were included in the study. The mean weight of the children included in the study was  $12.82 \pm 3.11$  kg. The mean zinc level of the children included in the study was  $83.9 \pm 14.44$  mcg/dl. About 66.7% of children in the age group of 6–12 months and 73.1% of children in the age group of 13–60 having zinc levels between 60 and 90 mcg/dl.

**Conclusion:** The mean serum zinc level was significantly lower in children with simple febrile seizures.

**Key words:** Children, Febrile, Seizures, Zinc

## INTRODUCTION

Febrile seizures are generally defined as seizures occurring in children typically 6 months–5 years of age in association with a fever  $>38^{\circ}\text{C}$  ( $100.4^{\circ}\text{F}$ ), who do not have evidence of an intracranial cause (e.g., infection, head trauma, and epilepsy), another definable cause of seizure (e.g., electrolyte imbalance, hypoglycemia, drug use, or drug withdrawal), or a history of an afebrile seizure.<sup>[1-5]</sup> Febrile seizure is a significant challenge in pediatric practice because of its high incidence in young children and its tendency to recur. In recent years, there has been more awareness about the potential complications of febrile seizures and management of this condition.

The cause of febrile seizures is multifactorial. It is generally believed that febrile seizures result from a vulnerability of the developing central nervous system (CNS) to the effects of fever, in combination with an underlying genetic predisposition and environmental factors.<sup>[4]</sup> Febrile seizure is an age-dependent response of the immature brain to fever.<sup>[6]</sup>

A detailed description of the seizure event is essential for the evaluation of a possible febrile seizure patient. Historical information regarding the exact appearance and length of the event is vital. Information regarding the symptoms of a CNS infection, underlying structural abnormalities, personal history of neurologic problems, personal immunization history, and personal or family history of prior seizure is essential in deciding whether an event of concern constitutes a febrile seizure or rather constitutes a more severe illness presenting with a seizure.<sup>[7]</sup>

The role of trace elements such as selenium, magnesium, copper, and zinc has been described in association with febrile seizures. Trace elements appear to play a role in their ability to modulate neurotransmission by acting on

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ion channels and their coenzyme activity.<sup>[8]</sup> Zinc is an important element in growth, development, and normal brain function. It is also an important cofactor for different enzymes involved in cellular growth and differentiation, the enzymatic activity of different organs, proteins, and cellular metabolism.

**Aim**

This study aims to study the association of zinc level with simple febrile seizures.

**MATERIALS AND METHODS**

This observational study was conducted in the Department of Paediatrics, Government Headquarters Hospital, Dindigul, from January 2019 to June 2019 in 6 months to 5 years. Children were admitted to the pediatric intensive care unit with simple febrile seizures. Inclusion criteria: Six months–5 years children with simple febrile seizures were included in the study. Exclusion criteria: Children <6 months and more than 5 years, with congenital anomalies and known cases of seizure were excluded from the study. Informed consent was obtained from the parents. Sociodemographic data, seizure details, nature of the febrile illness, family history of epilepsy/febrile seizures, the temperature at admission, nutritional status, and vital signs, namely, heart rate, respiratory rate, and blood pressure, were measured. The axillary temperature was recorded in all children with mercury thermometers placed in axilla for three minutes followed by general examination and systemic examination in detail. Serum zinc level was estimated along with other investigations at the time of admission.

**RESULTS**

In this study, 50 children from 6 to 60 months were included in the study. The mean age of the children included in the study was  $27.6 \pm 19.34$  years, 54% were male, and 46% were female. Children were divided into two groups with age, 48% were in 6–12 months age group and 52% were in 13–60 months age group [Figures 1 and 2]. The mean weight of the children included in the study was  $12.82 \pm 3.11$  kg. The mean zinc level of the children included in the study was  $83.9 \pm 14.44$  mcg/dl. According to age group, the mean zinc level in the age group of 6–12 months was  $84.41 \pm 13.67$  mcg/dl and in the age group 13–60 months was  $83.42 \pm 15.38$  mcg/dl. Zinc level was classified into two groups, 60–90 mcg/dl and 90–120 mcg/dl. About 66.7% of children in the age group of 6–12 months and 73.1% of children in the age group of 13–60 having zinc levels between 60 and 90 mcg/dl [Figures 3 and 4]. About 33.3% of children in the age group of 6–12 months and 29.9% of children in the age group of 13–60 having zinc levels

of children in the age group of 13–60 having zinc levels between 90 and 120 mcg/dl.

**DISCUSSION**

Zinc is an essential element in growth, development, and normal brain function. It is also an essential cofactor

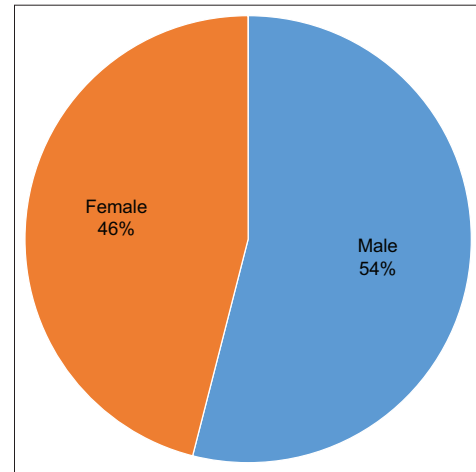


Figure 1: Gender distribution

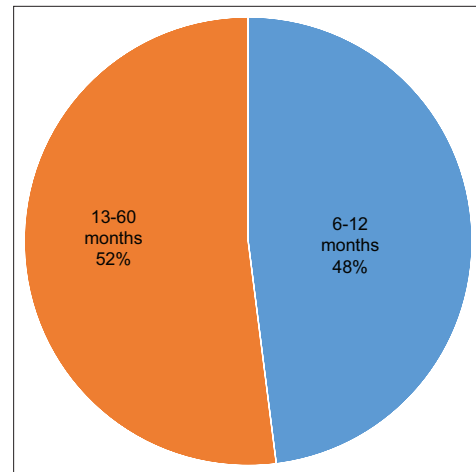


Figure 2: Age group distribution

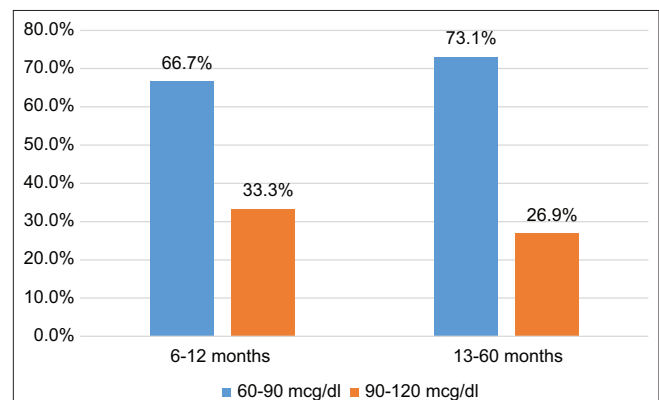


Figure 3: Comparison of age group with zinc level

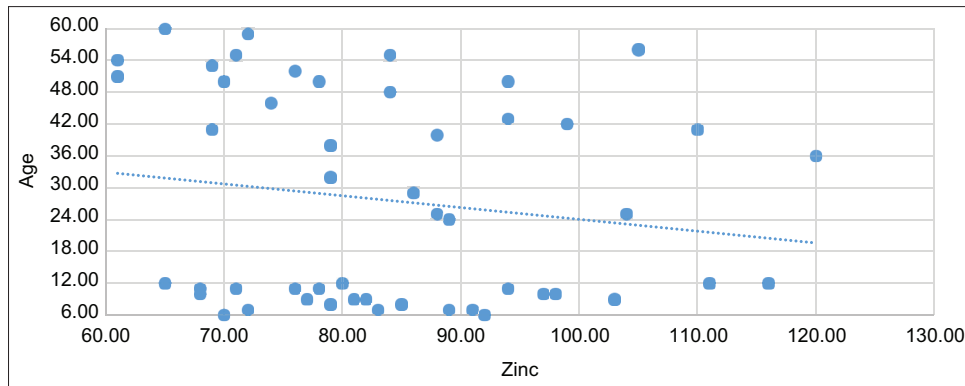


Figure 4: Correlation of zinc level with age group

for different enzymes involved in cellular growth and differentiation, the enzymatic activity of different organs, proteins, and cellular metabolism. In the brain, zinc is present in synaptic vesicles in a subgroup of glutaminergic neurons. In this form, it can be released by electrical stimulation and may serve to modulate responses at receptors for number of different neurotransmitters. These include excitatory and inhibiting receptors, particularly N-methyl-D aspartate and gamma-aminobutyric acid receptors.<sup>[9]</sup>

Zinc deficiency is implicated as a risk factor for febrile seizures. Several preliminary studies have shown that deficiencies in Vitamin B12, folic acid, selenium, calcium, and magnesium increase the risk of febrile seizures.<sup>[10]</sup> Other risk factors include a history of febrile seizure, febrile seizure in a first-degree relative, intrauterine growth retardation, staying in a neonatal nursery >28 days, neurodevelopmental delay, and daycare attendance.<sup>[11]</sup>

Heydarian *et al.* reported that the serum level of zinc was significantly lower in children with simple febrile seizures than febrile children without a seizure.<sup>[12]</sup> In Ehsanipour *et al.* study in Rasoul-e-Akram Hospital, serum zinc level was significantly lower in children with FC (cases group) than controls (children with non-convulsive fever and children with non-febrile convulsion).<sup>[13]</sup> Ganesh *et al.* from India reported that serum zinc levels are lower in children with febrile seizures than those with epileptic seizures and normal children.<sup>[14]</sup>

This study detected that serum zinc levels were significantly low in children who had simple febrile seizures compared to children who had fever without febrile seizures. Similar results were seen in other studies: Papierkowski *et al.* from Poland in 1999 who observed that serum and cerebrospinal fluid (CSF) zinc levels were significantly low in children with febrile seizures than healthy children in the control group.<sup>[15]</sup> Gündüz *et al.* from Turkey in 1996 observed that serum and CSF zinc levels decreased in children with

infectious diseases. This decrease was more significant in patients with febrile convulsions.<sup>[16]</sup> Kumar *et al.*<sup>[17]</sup> in 2011, Amiri *et al.*<sup>[18]</sup> (2010), and Mahyar.<sup>[19]</sup> in 2013 found out that mean serum zinc levels were significantly lower in children with febrile seizures than controls. In this study, serum zinc levels were significantly low in children who had seizures of prolonged duration, which is similar to the study done by Margaretha and Masloman in 2009.<sup>[20]</sup>

## CONCLUSION

In children with uncomplicated febrile seizures, mean serum zinc levels were lower. It's critical to figure out how zinc levels play a role in the pathophysiology of febrile seizures, as well as whether zinc supplementation can help avoid febrile seizures. When the children in the simple febrile seizure group were healthy, they should have received a follow-up serum zinc estimation to determine their baseline serum zinc level.

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