



Association of Serum Zinc Level with Febrile Seizures in Children

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: Febrile seizure (FS), previously known as febrile convulsion, is the most common seizure in children. FS usually occurs between six months and five years of age.

Aims and objectives: The main objective of the study is to find the association of serum zinc level with febrile seizures in children of Pakistan.

Material and methods: This cross sectional study was conducted at Mayo Hospital, Lahore during June 2020 to January 2021. The data was collected from 164 patients of both genders.

Results: The data was collected from 164 patients. In the case group, 46 children were male (53.3%), and 36 children (46.7%) were female. In the control group 44 children were male (43.3%) and 38 children were female (56.7%). The age of all participants was between one months and six years.

Conclusion: It is concluded that low serum zinc levels are fairly un-sufficient to support the hypothesis that Zinc deficiency could not be a potential risk factor for febrile seizure in children.

Keywords: Febrile seizure; zinc deficiency; convulsive disorders; seizure control

1. INTRODUCTION

Febrile seizure (FS), previously known as febrile convulsion, is the most common seizure in children. FS usually occurs between six months and five years of age. It is a genetic age-limited disorder, which only occurs with febrile illness. It is important to exclude central nervous system (CNS) infections and electrolyte imbalance before FS diagnosis. Also, patients should have no history of afebrile seizures. FS is classified into two simple and complex groups. Simple FS is generalized, lasts for 10-15 minutes, and occurs once in 24 hours. Conversely, complex FS is characterized by prolonged focal seizures, which occur more than once in 24 hours [1].

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 seizures [2]. 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 hours [3].

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 glutamate [4]. 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 [5]. Thus, decreased zinc levels lowers GABA synthesis which would precipitate seizures. Persistent and prolonged seizure activity cause cerebral edema, hypoxia, hyperthermia, hypoglycemia and vasomotor instability [6]. Respiratory depression may ensue

from involvement of respiratory centre or from drugs used for seizure control [7].

1.1 Aims and Objectives

The main objective of the study is to find the association of serum zinc level with febrile seizures in children of Pakistan.

2. MATERIALS AND METHODS

This cross sectional study was conducted at Mayo Hospital, Lahore during June 2020 to January 2021.

2.1 Inclusion Criteria

- Age 1-7 years
- Both male and female
- Willing to participate.

2.2 Exclusion Criteria

- Patients suffering from central nervous system infection, epilepsy, metabolic seizures.
- history of congenital structural anomalies of CNS
- Already on zinc therapy
- Not willing to participate

2.3 Data Collection

The data was collected from 164 patients of both genders. Within two to four hours of hospitalization, venous blood samples were collected for serum zinc measurements. Serum zinc level was measured by atomic absorption spectroscopy. The normal range of zinc in the serum was 70-110 mcg/dL, and zinc levels below 40 mcg/dL were indicative of zinc deficiency.

2.4 Statistical Analysis

The data was collected and analyzed using SPSS version 19. P-value less than 0.05 was considered statistically significant.

3. RESULTS

The data was collected from 164 patients. In the case group, 46 children were male (53.3%), and 36 children (46.7%) were female. In the control group 44 children

were male (43.3%) and 38 children were female (56.7%). The age of all participants was between one months and six years. The mean age of subjects in the FS and control groups was 33.1±14 and 31.5±7 months, respectively.

Table 1. Low Serum Zinc Level in Febrile Seizure Patients with Relation to Causes of Fever

Group Values	Mean ± SD
Children With Febrile Seizures	59.76 ± 42.78
Children With Febrile Without Seizures	86.24 ± 43.56
Healthy Children	110.0 ± 18.24

In the case group, the mean serum zinc level was 59.76 ± 42.78 mcg/dL in patients with simple FS and 86.24 ± 43.56 mcg/dL in patients with complex FS; there was no significant difference between these patients.

4. DISCUSSION

The results of most studies in this area are somewhat similar to our study. However, there are few studies reporting inconsistent results. Cho et al. showed that there was no significant difference in the serum zinc level of children with FS and control children. 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 factors [8]. 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 neurotransmitter [9].

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, and 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 patients [10]. Ganesh et al from Chennai, Lee et al, and Hitz et al also showed similar results [5]. The serum zinc levels did not show any significant correlation with age of onset, gender, family history and nutritional status in this present study [11].

5. CONCLUSION

It is concluded that low serum zinc levels are fairly un-sufficient to support the hypothesis that Zinc deficiency could not be a potential risk factor for febrile seizure in children.

CONSENT

As per international standard or university standard, patients written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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