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**Original Research Article**

# Serum ferritin levels in children of simple febrile seizures in tertiary institute

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## ABSTRACT

**Background:** Seizure onset is impacted by a number of variables, including genetics, diet, geography, concurrent illnesses, metabolic state, history of head trauma, and blood levels of particular minerals. Due to the fact that iron is required for the proper functioning of a number of enzymes and neurotransmitters in the central nervous system, low blood ferritin levels may lower the seizure threshold. The aim of the study was to determine the association between serum ferritin levels and simple febrile seizures.
**Methods:** The present observational study was conducted in department of pediatrics of a tertiary institute and included a total of 200 study subjects who visited to pediatric OPD/emergency room with febrile illness. The data was collected with the help of a structured clinical proforma. The collected data was recorded in Microsoft Excel sheet and statistical analysis was done with the help of SPSS version 21.0.
**Results:** In our study, the maximum number of the study subjects were between 13 and 24 months (35%) with male to female ratio 1.2:1. In patients with simple febrile seizure the mean Hb level was 9.1±1.4 gm/dl, the mean MCV was 72.6±7.4 f1, mean MCH was 23.73±3.2 pg and mean serum ferritin was 13.4±9.5 ng/ml as compared to those patients with febrile illness without seizure the mean Hb level was 11.5±1.2 gm/dl, mean MCV was 82.1±5.5 f1, mean MCH was 29.6±2.9 pg and mean serum ferritin was 33.6±20.2 ng/ml.
**Conclusions:** It is concluded that the low serum ferritin level is a risk factor of simple febrile seizure.

**Keywords:** Serum ferritin, Febrile seizures, Haemoglobin level

## INTRODUCTION

In the pediatric population, febrile seizures are one of the frequent causes of visits to the emergency room. Even though febrile seizures are frequently benign, they cause significant family stress and worry. Simple febrile seizures are initially generalised, typically tonic-clonic attacks accompanied by fever that last no more than 15 minutes and are not repeated within a 24-hour period. The commonest affected age group is 0-60 months children.[1,2]

Although the exact cause of febrile seizures is unknown, genetic and environmental factors are thought to be contributors in some way. Additionally, the development of seizures is influenced by factors like heredity, nutrition, geography, concomitant infections, metabolic conditions, history of head trauma, and blood levels of specific minerals. However, a distinct pattern of their involvement has still not been identified.[3,4]

Several recent research findings have suggested that iron deficiency anemia/low ferritin level may be a risk factor

for febrile seizure because febrile seizure is more prevalent in infants under two years of age and iron deficiency anemia is similarly prevalent in children of the same age.[5] Haemoglobin plays a critical function in the delivery of oxygen to several tissues, including the brain, because iron is a component of its structural makeup. Some neurotransmitters, such as monoamine and aldehyde oxidase, have slower metabolisms when there is an iron deficit (ID).[6-8]

By binding to iron, the protein ferritin contributes to the storage of iron within cells. Iron storage in cells is shown by the serum ferritin level, which is inversely proportional to body iron stores. The levels of ferritin, which are related to the body's total iron storage and can be used to gauge them, decline in iron deficiency anaemia and increase in iron excess. It is the most effective method for identifying an iron deficit.[9,10]

As the low blood ferritin levels may lower the seizure threshold because iron is necessary for the operation of several enzymes and neurotransmitters in the central nervous system.[11]

Thus, the present study was undertaken to analyse the serum ferritin levels in children of simple febrile seizures in tertiary institute.

### *Aim and objective*

The aim and objective of this study was to determine the association between serum ferritin levels and simple febrile seizures.

## METHODS

The present observational study was conducted in pediatric outpatient department in Acharya Shri Chander College of Medical Sciences and Hospital, from 1 April, 2023 to 28 February 2024 after obtaining approval from the Institutional Independent Ethical Committee wide reference number: ASCOMS/IEC/2023/Meeting-I/28, dated 18 March 2023. A total of 200 study subjects who visited to pediatric OPD/emergency room with febrile illness were included in the study after obtaining informed consent from their parents/guardians.

### *Inclusion criteria*

Children aged 6 months to 60 months presenting with febrile illness/simple febrile seizure were included in the study.

### *Exclusion criteria*

Study subjects whose parents/guardians refused to participate; subjects with comorbidities/other illnesses/ infection and congenital defects; and subjects on iron therapy were excluded.

A detailed history was collected and physical examination was done for all the study subjects. The venous blood sample was collected for routine laboratory examination and to determine the serum ferritin level and other minerals in the blood.

### *Statistical analysis*

The data was collected with the help of a structured clinical proforma. The collected data was recorded in Microsoft Excel sheet and statistical analysis was done with the help of SPSS version 21.0.

## RESULTS

In our study out of 200 study subjects, 149 study subjects were diagnosed with simple febrile seizures and mostly the subjects had 1st episode of seizure (65%) followed by 2nd episode of seizure (29%) and 3rd episode of seizure (6%).

**Table 1: Age distribution.**

| Age in months | N | % |
|---|---|---|
| **0-12** | 25 | 12.5 |
| **13-24** | 70 | 35 |
| **25-36** | 48 | 24 |
| **37-48** | 22 | 11 |
| **49-60** | 35 | 17.5 |

**Table 2: Gender distribution.**

| Gender | N | % |
|---|---|---|
| **Male** | 113 | 56.5 |
| **Female** | 87 | 43.5 |

**Table 3: Family history of febrile seizures.**

| Family history | N | % |
|---|---|---|
| **Yes** | 27 | 13.5 |
| **No** | 173 | 86.5 |

**Table 4: Laboratory findings.**

| Parameters | Patients with simple febrile seizure (n=149) | Patients with febrile illness without seizure (n=51) | P value |
|---|---|---|---|
| | Mean±SD | Mean±SD | |
| **Hb (gm/dl)** | 9.1±1.4 | 11.5±1.2 | 0.001 |
| **MCV (fl)** | 72.6±7.4 | 82.1±5.5 | 0.02 |
| **MCH (pg)** | 23.73±3.2 | 29.6±2.9 | 0.1 |
| **Serum ferritin (ng/ml)** | 13.4±9.5 | 33.6±20.2 | 0.001 |

The majority of the study subjects were in the age group of 13-24 months (35%) followed by 25-36 months (24%),

49-60 months (17.5%), 0-12 months (12.5%), and 37-48 months (11%) as presented in Table 1.

Table 2 shows that there was male predominance as the majority of the subjects were males (56.5%) followed by 43.5% females. The male-to-female ratio was 1.2:1.

It was found that out of 200 subjects, 13.5% were reported with a family history of febrile seizures as shown in Table 3.

Table 4 depicts the laboratory values. It was found that among patients with simple febrile seizure, the mean Hb level was 9.1±1.4 gm/dl, the mean MCV was 72.6±7.4 f1, the mean MCH was 23.73±3.2 pg and the mean serum ferritin was 13.4±9.5 ng/ml. Among patients with febrile illness without seizure the mean Hb level was 11.5±1.2 gm/dl, mean MCV was 82.1±5.5 f1, mean MCH was 29.6±2.9 pg and mean serum ferritin was 33.6±20.2 ng/ml. These findings suggested that when compared to subjects without febrile seizures, the subjects with simple febrile seizures had considerably lower mean serum ferritin, Hb, and MCV levels, which was statistically significant (p=0.001, p=0.001, and p=0.02 respectively).

## DISCUSSION

Out of 200 study participants, 149 were found to have simple febrile seizures. Of these, 65% had their first seizure, followed by 29% who had their second episode and 6% who had their third. These findings were similar to the study conducted by Shahari et al found that out of 150 participants, 32.7% had febrile seizures and 67% had febrile illness and among the patients with simple febrile seizure 22.4% had a history of seizure.[12] In another similar study performed by Gupta et al found that out of 170 study participants, 41.17% were reported with simple febrile seizure, and among them 68.6% had a first episode of seizure, whereas 31.4% had a history of seizure.[13]

The current study found a male predominance, a male-to-female ratio of 1.2:1, and that the majority of the study subjects were aged between 13 and 24 months (35%). 13.5% of the 200 participants reported having a family history of febrile seizures. These findings were similar to the study conducted by Kumar et al who observed that the most of the participants were in the age group of 1-2 years and there was male predominance with male to female ratio 1.9:1.[14] In another study conducted by Ghasemi et al it was found that the mean age of the study subjects was 27.13±15.74 months, most of the subjects were males and family history of febrile seizures was not found in majority of the participants.[15]

According to the study, participants with simple febrile seizures had statistically significant decreased mean serum ferritin, Hb, and MCV levels when compared to subjects without febrile seizures. These findings are in accordance with the studies conducted by Ghasemi et al Krishnamurthy et al Kumari et al and Kumar et al (2021), reported that there was a statistically significant association between simple febrile seizure and lower levels of serum ferritin, Hb, and MCV.[14-17]

According to another study by Mahajan et al out of a total of 120 patients, 74 (61.6%) were males and 46 (38.3%) were females. Approximately 11 (18.3%) patients in febrile group had positive family history.[19] Whereas in our study out of total 200 patients 113 (56.5) were male and 87 (43.5) were female with 27 (13.5) were having positive family history of febrile seizures.

### *Limitations*

The limitations of this study were a small sample size, short study period and premature subjects were not included in the study.

## CONCLUSION

The present study concludes that the patients having simple febrile seizures had significantly low serum ferritin levels. Thus, low serum ferritin is a risk factor of the development of simple febrile seizures.

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