

## A Case-Control Study to Assess the Relationship between Febrile Seizures and Iron Deficient Anaemia

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### Abstract

**Aim:** The purpose of this study was to assess relationship between febrile seizures and iron deficient anemia.

**Methods:** In this prospective hospital-based study, the Cases (n=50) were children between the ages of 1 and 5yr who experienced normal febrile convulsions (AAP clinical practise guidelines). A control group (n=50) was chosen from children who were admitted with febrile illness but no seizures and who were matched for age and sex.

**Results:** The outcome demonstrates that 86% (n=43) children from the case group had Hb 11 gm/dl in comparison to 24% (n=12) in the control group, with a significant p-value ( $p < 0.01$ ). In comparison to controls, the proportion of cases who had anemia was considerably higher ( $p = 0.012$ ). The outcome demonstrates that the MHL and MCV in patients were considerably lower than those in controls ( $p < 0.04$ ). RDW value in cases is substantially greater than in controls ( $p = 0.04$ ). The mean MCH levels in the two groups did not significantly differ ( $p > 0.04$ ). Regarding mean MCH levels, there was no discernible difference between the two groups ( $p > 0.04$ ). When compared to controls, serum iron and serum ferritin levels in patients were considerably lower ( $p < 0.01$ ). In cases compared to controls, the TIBC value is considerably greater ( $p = 0.01$ ).

**Conclusion:** According to the research, a sizable portion of children who experience febrile seizures have low serum iron levels and iron-deficiency anaemia. As a result, anaemia and low serum iron levels may act as a trigger for febrile seizures in young children.

**Keywords:** Iron-deficiency Anemia, Febrile convulsions, Children.

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### INTRODUCTION

The most prevalent convulsive condition in children is called febrile seizures (FS), and it affects 4.8/1000 children annually or 2-5% of all children. The term "fever-related seizures" refers to febrile seizures.

"Children between the ages of six months to six years old who have the condition present with a fever of 38°C and no additional symptoms indicative of CNS disorders or other potential triggers" [1].

Family history of convulsions or FS, brain injury, mothers who use or drink alcoholic beverages while pregnant, and a high temperature are also risk factors for this illness [2-6]. For healthy neurological processes and developing brains, iron is crucial. A connection between IDA and FS is likely due to the age prevalence of these conditions, which are similar to iron in that they play a role for synthesis of neurotransmitters like GABA, dopamine, and serotonin, as well as factors like monoaminoxidase, the function of haemoglobin in delivering oxygen to the brain, and fever, which exacerbate anemia-related symptoms.

The most typical clinical symptom of iron deficiency is anaemia, however other organs and systems may also be impacted. Cognitive impairment, psychomotor retardation, behavioural problems, pica, breath-holding episodes, restless leg syndrome, and thrombosis have all been linked to iron deficiency [9,10]. "The effects on the developing brain of iron deficiency and its mechanisms, such as altered hippocampus neuron development, impaired energy metabolism, delayed auditory evoked potentials, myelin maturation and slowed visual, and changes to synaptic neurotransmitter systems, which include norepinephrine, aminobutyric acid, dopamine, serotonin and glutamate may be the cause of these symptoms" [11]. Fever, on the other hand, might make iron deficiency's detrimental effects on the brain worse. Many research have looked at the connection between FS and iron deficiency anaemia (IDA), with mixed results.

To evaluate the connection between iron deficiency anaemia and the first episode of febrile seizures this case control study was conducted. Febrile seizures have been linked to maternal smoking, drinking alcohol while pregnant, and a family history of convulsions, but the causes are still mostly unclear. Aldehyde oxidase and monoamine levels are lowered in iron

deficiency anaemia, which is common between the second and third years of life and has been associated to behavioural and developmental problems. Many neurotransmitters are also metabolised with the help of iron. Hence, a case-control study can be utilised to investigate the connection between iron deficiency anaemia and febrile seizures.

## MATERIALS AND METHODS

This was an upcoming study conducted in Saphthagiri Institute of Medical Sciences and Research Centre, between January 2022 and August 2022 and the Cases (n=50) were children between the ages of 1 and 5 who experienced normal febrile convulsions (AAP clinical practise guidelines). Children who were admitted with febrile illness but no seizures and who were matched for age and sex made up the control group (n=50).

Haematological tests include those for haemoglobin, serum ferritin, MCH, MCV, RDW, serum iron, peripheral blood smear and TIBC. A variety of anthropometric measurements are taken, including height and length measured with a stadiometer and infantometer respectively and weight on an electronic scale. The circumference of the skull was measured with a plastic tape measure and the cross-tape method in order to assess protein-energy deficiency.

### Inclusion criteria

- Age between one and five years old
- A temperature of at least 38 degrees Celsius (100.4 degrees Fahrenheit).
- Not the outcome of a metabolic disorder or an infection of the central nervous system.
- Take place without a prior history of an afebrile seizure.
- Generalised primarily, typically tonic-clonic.
- Lasting no more than 15 minutes.
- Not repeated in a 24-hour period.

### Exclusion criteria

- Neurological infections in children

- Children who have developmental delays
- Children suffering with febrile/afebrile seizure

**Statistical Methods:** Using the proper statistical tools, statistical analysis was performed.

## RESULTS

**Table 1: Case distribution based on haemoglobin counts**

Haemoglobin Level(gm/dl)	Cases	Controls
No anemia ( $\geq 11$ gm/dl)	6 (12)	37 (74)
<b>Anemia</b>		
Mild anemia (10-10.9gm/dl)	12 (24%)	5 (10%)
Moderate anemia (7-9.9gm/dl)	30 (60%)	5 (10%)
Severe anemia ( $< 7$ gm/dl)	2 (4%)	3 (6%)

Table 1 demonstrates that 86% (n=43) of the case group's children had haemoglobin (Hb) levels below 11, compared to 24% (n=12) in the control group, with a significant p-value ( $p < 0.01$ ). When compared to controls, the proportion of cases who had anaemia was considerably higher ( $p = 0.012$ ).

**Table 2: Hematological parameters**

Parameters	Cases		Controls		P-Value
	Mean	SD	Mean	SD	
Hb(gm/dl)	9.10	1.65	10.06	1.66	$< 0.01$
MCV(fl)	67.89	15.32	17.65	9.96	$< 0.04$
MCH(pg)	21.98	5.11	24.80	5.77	0.063
RDW	17.99	6.78	16.19	2.34	$< 0.04$

Table 2 Shows, The MCV and mean hemoglobin level in patients were considerably lower than those in controls ( $p < 0.04$ ). RDW value in cases is substantially greater than in controls ( $p < 0.04$ ). Regarding mean MCH levels, there was no discernible difference between the two groups ( $p > 0.04$ ).

**Table 3: Mean levels of iron metabolic indicators in patients and controls**

Iron metabolic markers	Case (Mean)	Control (Mean)
Serum ferritin (mcg/L)	44.89	60.9
Iron (mcg/dL)	52.34	64.55
TIBC (mcg/dL)	389.67	331.33

When compared to controls, the levels of serum ferritin and iron in patients were considerably lower ( $p < 0.01$ ). In cases compared to controls, the TIBC value is considerably greater ( $p < 0.01$ ).

## DISCUSSION

The most frequent type of seizures in children, affecting 3 to 4% of them, are febrile seizures. Because to their potential link to epilepsy, research have tried to pinpoint the risk factors for them, including

prenatal factors, high temperature and febrile seizures family history. "Pisacane, et al.[14] reported that low iron level is associated with febrile seizure, whereas Kobrinsky, et al.[15] reported that iron deficiency raises the threshold for seizures". Seizure threshold may be

lowered by low amount of serum ferritin since iron is necessary for the proper functioning of several enzymes and neurotransmitters. Fever might increase low serum ferritin's detrimental effects on the brain and cause seizures.[14]

The majority of participants in the current study were men in both groups of participants. In the case group, there were 68% males and 32% females, according to a sex analysis. "Leela Kumari et al.[17] also reported 53% of male children in their study". Temperature, weight (Kg), height (Cm), and nutritional status were the factors examined in the current study. It was discovered that mean temperature differed between patients and controls, although this difference was not statistically significant ( $p$ -value = 0.412). This is consistent with research by Modaresi M et al.[18], Vaswani et al.[19], and Daoud et al.[20], which although it found a higher incidence of high temperature in the case group, did not find it to be statistically significant. When compared to controls, patients had a greater incidence of anaemia. Statistics showed that this difference was significant ( $p$  0.01).

Hb, MCV, MCH, RDW, serum iron, ferritin, and TIBC were measured in both cases and controls to determine the components of iron status. The mean serum iron levels and ferritin in the current study's FS group were discovered to be considerably lower than the equivalent levels in the control group ( $p < 0.01$ ). Iron deficiency anaemia is substantially more common among cases than among controls, according to Pisacane et al.[14] analysis of serum iron levels in controls and patients with FS.

## CONCLUSION

The results indicate that low serum iron and iron deficiency anemia affect a sizable portion of children experiencing febrile seizures. Previous studies investigating the connection between febrile seizures and iron deficiency anemia came up with conflicting results, and new information

was provided for this study. Yet, the study suggests that the preference bias and the unclear social standing are exceptional. Children having febrile seizures had IDA more often than those were suffering from the illness. According to the results, IDA may increase the risk of FFS. Children with FFS should undergo IDA monitoring. Fever can exacerbate anaemia's or iron deficiency's detrimental effects on the brain, which can cause seizures. On the other hand, anaemia can be linked to the prevalence of a febrile condition, and more grave cases may be more likely to result in epilepsy.

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