

IRON DEFICIENCY ANEMIA IN CHILDREN WITH FEBRILE FITS

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ABSTRACT

Background: Febrile seizures are common seizures often observed in children aged 6 months to 5 years. Some studies have explored the potential link between IDA and FS in young children.

Objective: To determine the association of iron deficiency anemia (IDA) with febrile fits in children.

Methods: This case-control study was conducted in Dr. Faisal Masood Teaching Hospital, Sargodha, from May 2025 to December 2025. In this study, the cases were the children who were admitted with febrile seizures, while the controls were those who presented with any other complaint in the hospital. The blood samples were drawn using a 5 cc BD syringe for evaluation of serum HB, MCV, Hct, and ferritin levels. Frequency of IDA was determined. Odds ratio was calculated to found out the association between IDA and febrile fits. OR>1 was considered statistically significant.

Results: The mean age was 24.9 (SD: 12.5) years. Among the participants, 127 (63.5%) were male and 73 (36.5%) were female. Cases exhibited a lower mean hemoglobin (HB) level (9.3 ± 1.1 g/dL) compared to controls (10.4 ± 1.2 g/dL; $P < 0.001$). Serum ferritin levels were substantially reduced in the case group (46.8 ± 25.2) versus the control group (82.4 ± 18.7 ; $P < 0.001$). The frequency of IDA was 33% among cases and 19% among controls, with odds ratio of 2.09 (1.09 to 4.02), demonstrating that cases had more than twice the odds of IDA compared to controls (p-value 0.02).

Conclusion: IDA is significantly associated with febrile seizures. Screening all children experiencing a first febrile seizure for iron deficiency is recommended. Early detection and iron supplementation may help prevent recurrence.

Keywords: Iron deficiency anemia (IDA), Febrile Fits, Children

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INTRODUCTION

Febrile seizures are common seizures often observed in children aged 6 months to 5 years. They occur in the context of a fever higher than 100.4 °F (38°C), without involving a central nervous system (CNS) infection. There is no specific fever temperature needed to trigger febrile seizures, as the convulsive threshold varies from one patient to another.^{1,2} It can occur during infections such as the flu, a cold, or an ear

infection. In some cases, a child might not have a fever at the time of the seizure but develops one a few hours afterward.³ Febrile seizures are classified into two main types. Simple febrile seizures involve a single episode that lasts no more than 15 minutes. In contrast, complex febrile seizures may include multiple episodes within a 24-hour period, may exhibit focal neurological signs, or last 15 minutes or longer.³

The primary factors that can raise the risk of febrile seizures include pre-existing neurological conditions, viral infections, a family history of seizures, developmental delays, and lower levels of serum zinc and iron, as well as influences such as maternal smoking and stress.⁴

In Pakistan, approximately 29.0% of children are diagnosed with iron deficiency anemia (IDA). It has been suggested that a lack of iron can hinder myelination of hippocampal neurons, leading to disruptions in energy metabolism and affecting the production and release of

key neurotransmitters such as gamma-aminobutyric acid (GABA), serotonin, and dopamine.^{5, 6} These neurochemical imbalances may subsequently contribute to the development of febrile seizures (FS). Several systematic reviews and meta-analyses have explored the potential link between IDA and FS in young children aged from three months to six years.⁷

In this study, we determined the association of iron deficiency anemia with febrile fits in children.

METHODS

This case-control study, including 200 patients, was conducted in the Department of Pediatrics at the DHQ Teaching Hospital, Sargodha. The study was conducted from 2025 to 2025. The cases were the children who were admitted with febrile seizures, while the controls were those who presented with any other complaint in the hospital. The exclusion criteria were: co-Morbid Conditions (congenital heart disease), atypical seizures, afebrile seizures, kidney disease, liver disease, asthma, children having CNS infection, and children already on iron therapy. Written consent was obtained from each patient.

The blood samples were drawn using a 5 cc BD syringe for evaluation of serum HB, MCV, Hct, and ferritin levels. The following criteria were used for diagnosis of IDA: Hb (<11gm/dl for age 6-59 months, <11.5 gm/dl for age 5-11 years, <12gm/dl for age 12-14 years), Hct <33%, RDW >17, and MCV <70fl in the blood of febrile fit children.

Data was analyzed using SPSS v25. Odds ratio was calculated to found out the association between IDA and febrile fits. OR>1 was considered statistically significant.

RESULTS

The mean age was 24.9 (SD: 12.5) years. Among the participants, 127 (63.5%) were male and 73 (36.5%) were female. The mean weight was 10.5 (SD 2.4) kilograms, and the mean height was 93 (SD: 12) centimeters. A positive family history of fits was reported by 10 (5.0%) participants.

Cases exhibited a lower mean hemoglobin (HB) level (9.3 ± 1.1 g/dL) compared to controls (10.4 ± 1.2 g/dL; $P < 0.001$). Mean corpuscular volume (MCV) was reduced in cases (68.3 ± 11.5 fL) relative to controls (81.5 ± 12.1 fL; $P < 0.001$). Red cell distribution width (RDW) was higher in cases ($19.2 \pm 1.7\%$) than in controls ($15.4 \pm 1.4\%$; $P < 0.001$). Hematocrit values were also lower in cases (27.8 ± 3.2) compared to controls (31.1 ± 4.5 ; $P < 0.001$). Serum ferritin levels were substantially reduced in the case group (46.8 ± 25.2) versus the control group (82.4 ± 18.7 ; $P < 0.001$) (Table 2).

The frequency of iron deficiency anemia (IDA) was 33% among cases (33 of 100) and 19% among controls (19 of 100). The odds ratio was 2.09, with a 95% confidence interval of 1.09 to 4.02, demonstrating that cases had

more than twice the odds of IDA compared to controls ($p = 0.02$) (Table 3).

Table 1. Baseline Characteristics.

Age	24.9±12.5
Gender (%)	
Male	127 (63.5%)
Female	73 (36.5%)
Weight (Kg)	10.5±2.4
Height (cm)	93±12
Family history of Fits (%)	
Yes	10 (5.0%)
No	190 (95%)

Table 2. Comparison of Laboratory Parameters.

	Cases (N=100)	Controls (N=100)	P-value
HB (g/dL)	9.3±1.1	10.4±1.2	<0.001
MCV (fL)	68.3±11.5	81.5±12.1	<0.001
Red cell distribution width (RDW) (%)	19.2±1.7	15.4±1.4	<0.001
Hematocrit	27.8±3.2	31.1±4.5	<0.001
Serum Ferritin	46.8±25.2	82.4±18.7	<0.001

Table 3. Comparison of IDA Frequency Between Cases and Controls.

IDA	Cases (N=100)	Controls (N=100)	Odds Ratio (95% CI)	P-value
Yes	33 (33%)	19 (19%)	2.09 (1.09-	0.02
No	67 (67%)	81 (81%)	4.02)	

DISCUSSION

Febrile seizures represent the most common form of seizure observed within pediatric populations, affecting approximately 2-5% of children.⁸ These seizures typically occur between 6 months and 5 years of age, with the highest incidence around 18 months, and occur in the absence of any signs of neuro-infection. The likelihood of experiencing another febrile seizure after the first is about 30-50%, with half of those children experiencing a second episode.³ Iron deficiency anemia is widespread among children under 4 years old and coincides with the peak period for simple febrile seizures, especially in developing nations where iron deficiency affects 46 to 66% of children aged 14 to 18 months.⁹

In our study, mean HB, MCV, Hct, and ferritin levels were lower among the case group (febrile fits) in comparison to controls.

Ghasemi and colleagues observed notable differences in average hematocrit, red blood cell count, ferritin, total iron-binding capacity, and transferrin saturation between individuals with febrile seizures and those without health issues.¹⁰ Fallah et al. observed that children with febrile seizures had lower hemoglobin levels than healthy peers—averaging 11.46 ± 1.18 g/dL versus 11.9 ± 0.89

g/dL, with a p-value of 0.042. Additionally, their serum iron concentrations were lower in febrile seizure cases (75.13 ± 35.57 mg/dL) than in healthy children (38.52 ± 11.38 mg/dL; $p=0.001$). The study also revealed that a greater proportion of children with febrile seizures had serum ferritin levels indicative of iron deficiency—48% compared to 28% in the control group—corresponding to an odds ratio of 4.3 ($p=0.03$). Furthermore, iron deficiency anemia was more prevalent among the affected children, affecting 22% of them versus 10% of the controls, with an odds ratio of 3.16 ($p=0.04$).¹¹ Jadhav and colleagues found similar results: the average serum transferrin was 22.46 in cases and 28.42 in controls ($p=0.029$). The mean TIBC was 434.84 in cases, significantly higher than controls' 334.46 ($p<0.001$). Serum iron was 77.64 in cases, lower than controls' 86.63 ($p=0.195$). RDW $>15\%$ was seen in 92% of cases versus 57% of controls.¹² A recent meta-analysis including 20 studies concluded that all iron indices such as high TIBC, IDA, low MCV, and low ferritin levels are associated with occurrence of febrile fits.⁷ Mandal et al. also reported similar findings.¹³

In our study, we find a significantly high incidence of IDA among children with febrile fits; 33% in comparison to 19% in the control group. According to the previous case-control study, about 32% of cases had IDA, whereas approximately 20% of controls had IDA. One meta-analysis also suggested that IDA has higher recurrence rates in cases with febrile fits than in controls.¹⁴ Research conducted by Ghasemi and colleagues revealed that 40% of children experiencing febrile seizures also suffered from IDA. In comparison, 26% of children with febrile illnesses but no seizures had the condition, whereas only 12% of healthy children were affected.¹⁰ Sankar et al. reported IDA in 29% children with febrile fits and in only 16% in control group.¹⁵

A case-control study enrolled 190 participants via nonprobability convenience sampling, with 95 cases and 95 controls. The cases have been defined as patients of either gender admitted to the pediatric unit with diagnosed febrile fits, while the controls have been defined as patients of either gender admitted to the pediatric unit with fever but without fits. Researchers have found that, in temperature statistics, the mean of $102.771 \pm 1.4278^\circ\text{F}$ has been recorded across all patients; 16.3% of patients have been diagnosed with iron deficiency anemia, compared to controls (p -value: 0.326). The study concluded that there is a slight positive correlation but no significant relationship between febrile fits and iron deficiency anemia.¹⁶

Kumari et al. demonstrated that iron deficiency, a family history of febrile seizure, and epilepsy are associated with the first febrile seizure. Addressing anemia promptly is essential, and managing iron deficiency should be integrated into standard pediatric care.¹⁷ In our study, we found a significant association of febrile fits with IDA.

Considering iron deficiency as a risk factor for febrile seizures, iron supplementation could serve as a preventive strategy. This approach is cost-effective, especially in developing countries like Pakistan.

CONCLUSION

IDA is significantly associated with febrile seizures. Screening all children experiencing a first febrile seizure for iron deficiency is recommended. Early detection and iron supplementation may help prevent recurrence.

ETHICAL APPROVAL

Ethical approval of article was granted by the Ethics Review Committee of Sargodha Medical College, Sargodha

AUTHOR'S CONTRIBUTIONS

MH: Conceived idea, design, manuscript writing

RR: Supervision, data analysis, proof reading

KMA: Data collection, data analysis & interpretation

All Authors: Approval of the final version of the manuscript to be published

CONFLICT OF INTEREST

Authors declare no conflict of interest.

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