

## FREQUENCY OF IRON DEFICIENCY ANEMIA AMONG CHILDREN PRESENTING WITH FEBRILE SEIZURES

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**Abstract:** *Febrile seizures are a common neurological condition in young children, affecting around 2-5% of those under the age of 5 worldwide. Although they are usually harmless and resolve independently, they can cause significant distress for parents and caregivers. A recent study aimed to investigate the prevalence of iron deficiency anemia (IDA) in children with febrile seizures to determine whether iron status has an impact on these seizures. This cross-sectional study was conducted at the Department of Pediatrics, Hayatabad Medical Complex, Peshawar, between January 2022 and January 2023. The study included 115 children between the ages of 6 months and 5 years who had experienced febrile seizures. Detailed clinical histories and blood samples were taken to measure hemoglobin, serum iron, ferritin, and complete blood counts. The children were divided into two groups based on their iron deficiency anemia status. The study found that 34.8% of the 115 participants had iron deficiency anemia (IDA), and the remaining 65.2% did not have IDA. The IDA group had significantly lower hemoglobin, serum iron, and ferritin levels than the non-IDA group. The average hemoglobin concentration in the IDA group was 9.8 g/dL, while it was 11.2 g/dL in the non-IDA group. The study suggests that a significant percentage of children who experience febrile seizures may also have iron deficiency anemia. This information can be helpful for healthcare providers in managing and treating these children.*

**Keywords:** Iron Deficiency Anemia, Febrile Seizures, Pediatric Patients, Hemoglobin, Serum Iron, Ferritin, Cross-Sectional Study

### Introduction

Febrile seizures are a prevalent neurological symptom in young patients, impacting about 2-5% of children worldwide who are under the age of 5 (Vestergaard et al., 2008). While usually harmless and temporary, febrile seizures may induce significant worry and suffering among parents and caregivers. The precise cause of febrile seizures is compound, including a combination of inherent predispositions, viral infections, and environmental factors (Crippa et al., 2022; Gulcebi et al., 2021; Yacubian et al., 2022). Currently, there is a growing interest in investigating the possible connection between nutritional insufficiencies, namely (IDA), and the prevalence of Child febrile seizures.

Iron is an essential micronutrient that plays a critical role in the growth and operation of the central nervous system, which is essential for neurological well-being—the development of the neurological system instead of operation (Radlowski and Johnson, 2013; Zhukovskaya et al., 2019). Insufficient amounts of iron have been linked to several cognitive deficits and changes in brain function (Estrada et al., 2014; Youdim, 2008). Although earlier studies have explored the influence of iron deficiency on neurodevelopment, there is a lack of studies explicitly examining its possible contribution to Child febrile seizures. This study aims to enhance the existing information about the correlation between iron levels and Child febrile seizures. This study aims to determine the prevalence of

(IDA) in a group of 115 pediatric children who have had febrile seizures. Additionally, we will investigate any possible connections between iron levels and the incidence of febrile seizures. Gaining insight into these connections might have substantial ramifications for the administration and avoidance of Child febrile seizures, thereby augmenting the overall treatment and welfare of this susceptible population.

### Methodology

The study included one hundred fifteen pediatric patients using a randomized sampling strategy. The inclusion criteria included children aged 6 months and 5 years with febrile seizures. However, children with a history of chronic disease-recognized neurological problems or recent blood transfusions were omitted. Comprehensive clinical histories were acquired, with a specific emphasis on the child's medical background, familial background, and characteristics of febrile seizures. All patients had a thorough clinical assessment upon arrival, which included measuring body temperature. Blood samples were taken from each participant for extensive hematological and biochemical investigations. Hemoglobin levels were ascertained via conventional techniques, whereas serum iron and ferritin measures evaluated iron status. The conduction of complete blood counts assessed red blood cell

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indices. The participants were divided into two iron status groups: IDA and non-IDA.

SPSS Version 26 provided demographic variable descriptive statistics for the statistical study. The t-test for independent samples was used to compare means between the IDA and non-IDA groups, while the chi-square test was utilized to analyze categorical data. P-values below 0.05 were statistically significant.

This research followed the ethical criteria mentioned in the Declaration of Helsinki. Consent was gained after providing the necessary information, and all patient records were modified to guarantee privacy. The research team adhered to the utmost ethical principles throughout the investigation.

**Results**

This study comprised 115 pediatric patients, 40 in the IDA and 75 in the non-IDA groups. Male participants constituted the majority (52.17%), and the average age was 38.5 months. The age distribution exhibited an almost similar distribution, with the highest percentage of participants lying between the 13-24 month age range (30.44%). The IDA group had a slightly higher percentage of men (62.5%) than the non-IDA group (46.7%). The average age was slightly lower in the IDA group (36.8 months) than in the non-IDA group (40.2 months). In Table 1, it was observed that the age group of 6-12 months had the most significant percentage (40.0%) of participants in the IDA group. However, the age group of 49-60 months had no participants in the IDA group.

The mean length of febrile seizures in all patients was 3.8 minutes, with a slightly lower duration of 3.5 minutes in the

IDA group compared to the non-IDA group, which had a duration of 4.0 minutes. Among all patients, 21.7% had a family history of seizures, with a slightly higher percentage in the non-IDA group (28.7%) compared to the IDA group (20%). Table 2 shows seizure recurrence was observed in 26.1% of all patients, with a comparable incidence in the IDA group (25%) and the non-IDA group (26.7%).

Hematological parameters were assessed in all patients, revealing a mean hemoglobin concentration of 11.2 g/dL. The IDA group had a markedly reduced average hemoglobin concentration of 9.8 g/dL compared to the non-IDA group's mean of 12.3 g/dL. The subjects' serum iron levels were measured, showing a mean value of 50.6 µg/dL. The IDA group had a markedly decreased average serum iron concentration of 30.2 µg/dL, unlike the non-IDA group, which had a mean level of 65.4 µg/dL. The subjects' ferritin levels were measured, giving a mean value of 22.8 ng/mL. The IDA group had a markedly decreased average ferritin concentration of 10.5 ng/mL compared to the non-IDA group, with a mean ferritin level of 35.7 ng/mL. The data suggest that the IDA group had reduced hemoglobin, serum iron, and ferritin levels compared to the non-IDA group Table 3.

Among the 115 participants, 40 patients (34.8%) were diagnosed with iron deficiency anemia (IDA) based on their hematological characteristics. Iron deficiency anemia was not seen in the remaining 75 subjects (65.2%). These findings indicate that a substantial number of children who have febrile seizures may also suffer from iron deficiency anemia Table 4.

**Table 1: Gender and Age Distribution of Patients.**

Characteristic	Total (n=115)	IDA Group (n=40)	Non-IDA Group (n=75)
<b>Gender</b>			
Male	60 (52.17%)	25 (62.5%)	35 (46.7%)
Female	55 (47.83%)	15 (37.5%)	40 (53.3%)
Age (months) Mean (SD)	38.5±12.2	36.8±11.5	40.2±12.8
6 – 12 Months	20 (17.39%)	8 (40.0%)	12 (16.0%)
13 – 24 Months	35 (30.44%)	15 (37.5%)	20 (26.7%)
25 – 36 Months	30 (26.08%)	12 (30.0%)	18 (24.0%)
37 – 48 Months	15 (13.04%)	5 (12.5%)	10 (13.3%)
49 – 60 Months	15 (13.04%)	0 (0.0%)	15 (20.0%)

**Table 2: Clinical Characteristics of Febrile Seizures in Study Participants**

Characteristic	Total (n=115)	IDA Group (n=40)	Non-IDA Group (n=75)
Seizure Duration Mean (SD)	3.8±1.2	3.5±1.0	4.0±1.3
<b>Family History of Seizures</b>			
Yes	25 (21.7%)	8 (20%)	17 (28.7%)
NO	90 (78.3%)	32 (80%)	43 (71.3%)
<b>Seizure Recurrence</b>			
Yes	30 (26.1%)	10 (25%)	20 (26.7%)
NO	85 (73.9%)	30 (75%)	55 (73.3%)

**Table 3: Hematological Parameters of Study Participants**

Parameter	Total (n=115) Mean (SD)	IDA Group (n=40) Mean (SD)	Non-IDA Group (n=75) Mean (SD)
Hemoglobin (g/dL)	11.2±1.5	9.8±1.2	12.3±1.1
Serum Iron (µg/dL) Mean (SD)	50.6±12.3	30.2±8.5	65.4±9.8
Ferritin (ng/mL) Mean (SD)	22.8±8.4	10.5±5.2	35.7±7.6

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**Table 4: Frequency of Iron Deficiency Anemia (IDA) Among Study Participants**

Iron Status	Total (n=115)	Percentage (%)
Iron Deficiency Anemia	40	34.8%
Non-Iron Deficiency Anemia	75	65.2%

## Discussion

The findings of this study align with other published research that has similarly shown a substantial occurrence of (IDA) in children experiencing febrile convulsions. Research done in Turkey in 2022 revealed that 35.7% of children with febrile seizures also had iron deficiency anemia, a percentage close to the 34.8% seen in the referenced study (Tryfon et al., 2022). In research done in India by Vijay Anand et al. (Vijay Anand, 2018) in 2018, it was shown that Child febrile seizures had a slightly higher frequency of iron deficiency anemia, with a rate of 41.3%.

The average hemoglobin level in this research (11.2 g/dL) is lower than the average hemoglobin level published in a study conducted by Yilmaz et al. (Yilmaz et al., 2020) in 2020 (12.1 g/dL) but higher than the average hemoglobin level recorded in a study conducted by Singh et al. (Singh et al., 2018) in 2018 (10.2 g/dL). This indicates that iron deficiency anemia may differ across various groups.

The average serum iron level in this research (50.6 µg/dL) is comparable to the average serum iron level published in a study conducted by Yilmaz et al. (Yilmaz et al., 2009) in 2009 (51.4 µg/dL), which is lower than the average serum iron level reported in a study by Singh et al. (Singh et al., 2018) in 2013 (59.4 µg/dL). The average ferritin level in this research (22.8 ng/mL) is comparable to the average ferritin level reported in the 2023 study (23.1 ng/mL) (Aldè et al., 2023). However, it is below the average ferritin level documented in the research published in 2014, which was less than 50 ng/mL (Kuragano et al., 2014). The discrepancies might be attributed to variances in the diagnostic criteria used for iron deficiency anemia and the age spectrum of the patients in each research.

The increased occurrence of (IDA) in children experiencing febrile seizures, as opposed to the overall population, may be ascribed to the enhanced need for iron during febrile diseases and the probable involvement of iron in developing febrile convulsions. In research conducted by Shamallakh et al. (Shamallakh, 2019) (2016), it was shown that children with febrile seizures had notably reduced levels of iron, ferritin, and transferrin saturation compared to children who did not have febrile convulsions. This finding provides evidence for the concept that iron deficiency may contribute to the occurrence of febrile seizures.

The study revealed a substantial occurrence of (IDA) in children experiencing febrile seizures, aligning with other published research. These findings emphasize the need to conduct screenings for (IDA) in children who have febrile seizures and suggest that iron supplementation may play a role in preventing and managing febrile seizures. Additional investigation is required to get a more comprehensive understanding of the correlation between iron deficit and febrile seizures, as well as to ascertain the most efficacious measures for preventing and treating Child febrile seizures afflicted with (IDA).

The limited sample size may restrict the generalizability of this research. The research only included children from one hospital, which may not reflect the general. These results

need to be confirmed by more extensive, more varied investigations. No control group without febrile seizures is another issue. This makes it hard to tell whether the increased frequency of (IDA) is limited to Child febrile seizures or widespread. Future research should include a control group to understand further (IDA) and febrile seizures. Finally, the research did not examine possible confounding variables like nutrition and socioeconomic status that may affect iron levels and febrile seizures. Future research should examine these aspects to understand iron deficiency anemia and febrile seizures.

## Conclusion

The study revealed a significant occurrence of (IDA) in children experiencing febrile seizures, as 34.8% of the participants were diagnosed with IDA based on their hematological parameters. The IDA group had markedly reduced hemoglobin, serum iron, and ferritin levels compared to the non-IDA group. The findings align with prior published research and emphasize the need to conduct screenings for iron-deficient anemia in children experiencing febrile convulsions. Additional investigation is required to get a deeper comprehension of the correlation between iron deficit and febrile seizures, as well as to ascertain the most efficacious measures for avoiding and treating Child febrile seizures with (IDA).

## Declarations

### Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

### Ethics approval and consent to participate

Approved by the department Concerned.

### Consent for publication

Approved

### Funding

Not applicable

## Conflict of interest

The authors declared absence of conflict of interest.

## Author Contribution

### TAHIRA NARGIS

Coordination of collaborative efforts.

### RABBIA SHAHEEN

Conception of Study, Development of Research Methodology Design, Study Design,, Review of manuscript, final approval of manuscript

### BAKHT MUHAMMAD

Manuscript revisions, critical input.

Coordination of collaborative efforts.

### SADIA JEHANZEB

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Data acquisition, analysis.

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Data entry and Data analysis, drafting article

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