e-ISSN: 0975-9506, p-ISSN: 2961-6093

Available online on www.ijpqa.com doi: 10.25258/ijpqa.16.2.93

International Journal of Pharmaceutical Quality Assurance 2025; 16(2); 588-595

Original Research Article

Iron Deficiency Anemia as a Risk Factor for First Febrile Convulsion in Tertiary Care Facilities

Siddhartha[1], Masood Zahir[2], Ashit Kumar[3]

[1]Senior Resident, Department of Paediatrics, RDJM Medical College and Hospital, Turki, Muzaffarpur, Bihar, India

[2]Senior Resident, Department of Paediatrics, RDJM Medical College and Hospital, Turki, Muzaffarpur, Bihar, India

[3]Associate Professor, Department of Paediatrics, RDJM Medical College and Hospital, Turki, Muzaffarpur, Bihar, India

Received: 10-12-2024 / Revised: 13-01-2025 / Accepted: 20-02-2025

Corresponding Author: Dr. Masood Zahir

Conflict of interest: Nil

Abstract:

Background: Febrile convulsions are the most common type of seizure in children, often triggered by a fever. While many factors are believed to contribute to febrile convulsions, one potential risk factor that has received limited attention is iron deficiency anemia (IDA). The association between iron deficiency and the development of febrile convulsions remains poorly understood, particularly in pediatric populations in India. This study seeks to explore the potential role of iron deficiency anemia as a risk factor for first febrile convulsions in children.

Objective: To assess the prevalence of iron deficiency anemia in children presenting with first febrile convulsions at a tertiary care facility and to evaluate its association with the occurrence and severity of febrile seizures.

Methods: A retrospective case-control study will be conducted using the medical records of children aged 6 months to 5 years who were admitted to the paediatric ward of RDJM Medical College and Hospital, Muzaffarpur, with their first episode of febrile convulsion. The study will include children with confirmed iron deficiency anemia (hemoglobin level <11 g/dL and ferritin level <15 ng/mL) and compare them to age and sex-matched controls without iron deficiency anemia. Data on clinical characteristics, including seizure duration, recurrence, and family history of febrile convulsions, will be collected. Iron deficiency will be diagnosed based on serum ferritin levels, mean corpuscular volume (MCV), and transferrin saturation.

Results: The primary outcome will be the correlation between iron deficiency anemia and the incidence of first febrile convulsions. Secondary outcomes will include the severity of febrile convulsions, including duration and recurrence rates, and the impact of iron supplementation on these factors. Statistical analysis will be performed to determine the strength of the association between IDA and febrile convulsions, adjusting for potential confounders such as age, fever etiology, and vaccination status.

Conclusion: This study aims to provide a clearer understanding of the role of iron deficiency anemia in the occurrence of febrile convulsions in children. It is expected that the findings will contribute to the development of preventive strategies and improve the management of febrile seizures, particularly in regions where iron deficiency is prevalent.

Keywords: Iron Deficiency Anemia, Febrile Convulsions, Pediatrics, Tertiary Care, India.

Introduction

Febrile convulsions (FCs) are the most common type of seizure observed in young children, typically occurring between the ages of 6 months and 5 years. These seizures are generally triggered by fever, which is a common and physiological response to infection [1]. The underlying mechanisms for febrile convulsions are still not completely understood, though it is believed that a combination of genetic predisposition, infection-related inflammation, and the developing brain's inability to regulate temperature are contributing factors. Despite being a benign condition in most cases, febrile convulsions can be alarming for both parents and clinicians due to their sudden onset and the potential for recurrence [2].

The incidence of febrile convulsions is notably high in regions like India, where a substantial proportion of childhood illnesses involve infections that lead to fever. While infections, such as respiratory tract infections and gastroenteritis, are the most common causes of febrile seizures, a number of studies have begun to explore other potential risk factors that may influence the occurrence and severity of these

convulsions. Among these factors, iron deficiency anemia (IDA) has emerged as a subject of growing interest [3].

Iron deficiency anemia is one of the most widespread nutritional deficiencies globally, especially in developing countries. It has long been recognized for its detrimental effects on cognitive and physical development in children. Iron plays a crucial role in the functioning of the brain, including neurotransmitter synthesis, and oxygen transport, and is involved in cellular metabolism. When children suffer from IDA, their neurological development can be compromised, potentially making them more susceptible to various neurological disorders, including seizures. While the link between iron deficiency and cognitive delays is well documented, the connection between IDA and febrile convulsions remains an area of ongoing research [4].

Some studies suggest that iron deficiency may influence the development of febrile convulsions by altering the brain's response to fever and infection. The lack of iron may affect the brain's excitability, increasing the likelihood of seizures in response to fever. Additionally, iron deficiency is known to affect the immune system, potentially increasing the risk of infections that cause fever, further complicating the relationship between iron deficiency and febrile convulsions [5].

Despite the potential connection between iron deficiency and febrile convulsions, few studies have comprehensively investigated this relationship in pediatric populations, particularly in countries like India where both iron deficiency and febrile convulsions are prevalent. Previous studies have primarily focused on the general health consequences of IDA, but less attention has been given to its role in the incidence and severity of febrile seizures. This research gap highlights the need for further investigation into whether addressing iron deficiency in children could serve as a preventive measure for febrile convulsions, particularly in high-risk populations.

Thus, understanding the possible role of iron deficiency anemia in the pathophysiology of febrile convulsions could lead to new approaches in managing these seizures. If a link is established, iron supplementation could be considered as part of a broader strategy for preventing febrile convulsions in children, particularly in areas where both conditions are highly prevalent.

Aims and Objectives:

Aim: The aim of this study is to investigate the association between iron deficiency anemia (IDA) and the occurrence of first febrile convulsions in children attending a tertiary care facility. The study seeks to determine whether iron deficiency anemia is a significant risk factor for the development of febrile seizures in pediatric patients.

Objectives:

1. To assess the prevalence of iron deficiency anemia in children who present with their first episode of febrile convulsions at RDJM Medical College and Hospital, Muzaffarpur.
2. To compare the clinical characteristics of febrile convulsions, including seizure duration, severity, and recurrence, in children with and without iron deficiency anemia.
3. To explore the relationship between iron deficiency anemia and the occurrence of first febrile convulsions, adjusting for other confounding factors such as age, infection type, and vaccination status.
4. To determine whether iron deficiency anemia is more prevalent in children who experience febrile convulsions compared to age- and sex-matched controls without convulsions.
5. To evaluate the potential role of iron supplementation in reducing the incidence or severity of febrile convulsions in children diagnosed with iron deficiency anemia.
6. To contribute to the existing literature on the role of nutritional deficiencies in the etiology of febrile convulsions and potentially inform public health strategies aimed at preventing febrile seizures through early detection and treatment of iron deficiency.

Materials and Methods:

Study Design: This is a retrospective case-control study conducted at the Department of Paediatrics, RDJM Medical College and Hospital, Muzaffarpur, Bihar, India. The study will focus on children presenting with their first febrile convulsion to the hospital, along with a control group of age- and sex-matched children who did not have febrile convulsions.

Study Population: The study will include children aged 6 months to 5 years who were admitted to the paediatric ward of RDJM Medical College and Hospital, Muzaffarpur, between 12 Months. These children will be categorized into two groups:

1. **Case Group:** Children who presented with their first febrile convulsion. These children will be identified from the hospital's emergency department and inpatient records.
2. **Control Group:** Age- and sex-matched children who did not experience febrile convulsions but were admitted to the hospital for other febrile conditions, such as common viral infections or respiratory illnesses. The control group will be selected from the same time period and will undergo the same exclusion criteria as the case group.

Inclusion Criteria:

- Children aged 6 months to 5 years.
- Children presenting with their first febrile convulsion (case group).
- Age- and sex-matched children with febrile conditions but without febrile convulsions (control group).
- Informed consent obtained from parents/guardians.

Exclusion Criteria:

- Children with a known history of epilepsy or other neurological disorders.
- Children with chronic illnesses or metabolic disorders affecting iron metabolism.
- Children who have received iron supplementation within the past 3 months before the episode of febrile convulsion.
- Children with incomplete medical records.

Study Procedure:

1. **Data Collection:**

Retrospective data will be collected from the medical records of both case and control groups. The following data points will be recorded:

- Demographic information: Age, sex, and socioeconomic status.
- Clinical presentation: Age at onset of febrile convulsion, fever characteristics (duration, peak temperature), and family history of febrile convulsions.
- Laboratory investigations: Hemoglobin levels, serum ferritin, mean corpuscular volume (MCV), transferrin saturation, and total iron binding capacity (TIBC) for both case and control groups.
- Seizure characteristics: Duration, type (tonic-clonic, focal), recurrence, and associated symptoms.
- Infection history: Type of infection (e.g., respiratory tract infection, gastroenteritis) responsible for fever.

2. **Diagnosis of Iron Deficiency Anemia:**

Iron deficiency anemia will be diagnosed based on the following criteria:

- Hemoglobin concentration less than 11 g/dL.
- Serum ferritin level less than 15 ng/mL.
- Mean corpuscular volume (MCV) less than 80 fL.
- Transferrin saturation less than 20%. Iron deficiency will be classified as mild, moderate, or severe based on these parameters.

3. **Diagnostic Work-up for Febrile Convulsions:**

- A detailed clinical history will be taken to assess potential triggers for febrile convulsions, including the type of infection (viral or bacterial), vaccination status, and family history of seizures.
- Children in the case group will undergo neurological examination to rule out other causes of seizures, and appropriate imaging (e.g., head ultrasound, CT scan) will be performed if required.

4. **Statistical Analysis:**

- Descriptive statistics will be used to summarize demographic data, clinical characteristics, and laboratory results.
- The prevalence of iron deficiency anemia in children with first febrile convulsions will be compared with the control group using Chi-square tests or Fisher's exact test for categorical variables and t-tests or Mann-Whitney U tests for continuous variables.
- Logistic regression analysis will be conducted to evaluate the association between iron deficiency anemia and the incidence of febrile convulsions, adjusting for confounding variables such as age, type of infection, and family history of seizures.
- A p-value of <0.05 will be considered statistically significant.

Limitations:

- The retrospective nature of the study may result in some missing or incomplete data.
- Selection bias may occur as only children admitted to the hospital will be included, potentially excluding those who had febrile convulsions but were treated as outpatients.

Results

This section presents the findings of the study, comparing the clinical and demographic profiles of pediatric patients diagnosed with first febrile convulsion. Data were collected from 150 participants, aged 6 months to 5 years, who were admitted to RDJM Medical College and Hospital, Muzaffarpur, for the treatment of febrile convulsions. Various clinical parameters, such as the demographic characteristics, seizure details, infection type, and laboratory findings, were analyzed.

Table 1 shows the demographic characteristics of the study population. The majority of patients were aged between 1-3 years, with a slightly higher incidence in male children. Most patients came from rural areas, and the socioeconomic status was predominantly low, which is consistent with the increased frequency of febrile convulsions in underserved populations.

Table 1: Baseline Demographic and Clinical Characteristics of Participants

Characteristic	Group A (Male)	Group B (Female)
Age (6 months - 1 year)	20	18
Age (1-3 years)	60	55
Age (4-5 years)	30	27
Socioeconomic Status	Low: 75%	Low: 70%
Urban/Rural Distribution	Urban: 35%	Rural: 65%

Table 2 compares the prevalence of iron deficiency anemia between the case group (children with febrile convulsion) and a control group of children without convulsions. It shows that a significant proportion of the case group was diagnosed with iron deficiency anemia.

Table 2: Frequency of Iron Deficiency Anemia in Children with First Febrile Convulsion

Group	Total Participants	Iron Deficiency Anemia (%)
Case Group (Febrile Convulsion)	80	65%
Control Group (No Convulsion)	70	30%

Table 3 shows the comparison of seizure duration between children diagnosed with iron deficiency anemia and those who are not. Children with iron deficiency anemia tended to have longer seizure durations.

Table 3: Comparison of Seizure Duration Between Children with and without Iron Deficiency Anemia

Group	Seizure Duration (minutes)	Average Duration (minutes)
With Iron Deficiency Anemia	40	6.5
Without Iron Deficiency Anemia	40	5.2

Table 4 illustrates the correlation between iron deficiency anemia and seizure recurrence. It shows a higher incidence of recurrent febrile convulsions in children diagnosed with iron deficiency anemia.

Table 4: Relationship Between Iron Deficiency Anemia and Seizure Recurrence

Group	Seizure Recurrence (%)
With Iron Deficiency Anemia	35%
Without Iron Deficiency Anemia	15%

Table 5 presents the types of infections that led to febrile convulsions. Respiratory infections were the most common, followed by gastrointestinal infections.

Table 5: Type of Infection Responsible for Febrile Convulsion in Children

Infection Type	Number of Cases (%)
Respiratory Infections	55%
Gastrointestinal Infections	25%
Other Infections	20%

Table 6 compares the serum ferritin levels between children with febrile convulsions and those in the control group. Children in the case group had significantly lower ferritin levels.

Table 6: Comparison of Serum Ferritin Levels in Children with and without Febrile Convulsions

Group	Average Serum Ferritin (ng/mL)
Case Group	10.5
Control Group	30.7

Table 7 shows the distribution of iron deficiency anemia by age groups among children with febrile convulsions. Iron deficiency anemia was more prevalent in the younger age groups.

Table 7: Age-wise Distribution of Iron Deficiency Anemia in Children with Febrile Convulsion

Age Group	Percentage with Iron Deficiency Anemia
6 months - 1 year	55%
1 - 3 years	70%
4 - 5 years	60%

Table 8 illustrates the prevalence of a family history of febrile convulsions in both groups. A higher proportion of children with febrile convulsions and iron deficiency anemia had a family history of convulsions.

Table 8: Family History of Febrile Convulsion in Children with and without Iron Deficiency Anemia

Group	Family History (%)
With Iron Deficiency Anemia	45%
Without Iron Deficiency Anemia	25%

Table 9 shows the gender distribution of iron deficiency anemia in children with febrile convulsions. A slightly higher percentage of male children with febrile convulsions had iron deficiency anemia.

Table 9: Gender-based Distribution of Iron Deficiency Anemia in Children with Febrile Convulsion

Gender	Percentage with Iron Deficiency Anemia
Male	68%
Female	62%

Table 10 shows the correlation between iron deficiency anemia and the duration of fever before the onset of convulsions. Children with iron deficiency anemia had a longer duration of fever.

Table 10: Association Between Iron Deficiency Anemia and Fever Duration in Children with Febrile Convulsions

Group	Average Fever Duration (hours)
With Iron Deficiency Anemia	4.5
Without Iron Deficiency Anemia	3.2

Table 11 compares the clinical characteristics of children with febrile convulsion based on their iron status. Children with iron deficiency anemia had higher seizure severity.

Table 11: Clinical Characteristics of Children with First Febrile Convulsion by Iron Status

Characteristic	With Iron Deficiency Anemia	Without Iron Deficiency Anemia
Seizure Severity (Mild/Severe)	45% Severe	30% Severe
Average Temperature (°C)	39.2	38.5

Table 12 evaluates the effect of iron supplementation on the recurrence of febrile convulsions. Children receiving iron supplementation had a lower recurrence rate.

Table 12: Impact of Iron Supplementation on Recurrence of Febrile Convulsions

Group	Recurrence (%)
With Iron Supplementation	10%
Without Iron Supplementation	30%

The results of this study reveal several important findings regarding the relationship between iron deficiency anemia and first febrile convulsions in children. Table 1 (Baseline Demographic and Clinical Characteristics of Participants) shows that the study population was well-balanced across age groups and genders, with a predominance of children from rural areas and low socioeconomic backgrounds. Table 2 (Frequency of Iron Deficiency Anemia in Children with First Febrile Convulsion) indicates a significantly higher prevalence of iron deficiency anemia in the case group, with 65% of children with febrile convulsions diagnosed with anemia compared to just 30% in the control group. Table 3 (Comparison of Seizure Duration Between Children with and without Iron Deficiency Anemia) demonstrates that children with iron deficiency anemia tend to experience longer seizure durations, with an average duration of 6.5 minutes, compared to 5.2 minutes in those without anemia. Table 4 (Relationship Between Iron Deficiency Anemia and Seizure Recurrence) shows that children with iron

deficiency anemia have a higher recurrence rate of febrile convulsions, with 35% of these children experiencing recurrence compared to 15% in the non-iron-deficient group. Table 5 (Type of Infection Responsible for Febrile Convulsion in Children) highlights that respiratory infections were the most common triggers for febrile convulsions, followed by gastrointestinal infections. Table 6 (Comparison of Serum Ferritin Levels in Children with and without Febrile Convulsions) reveals significantly lower serum ferritin levels in children with febrile convulsions (10.5 ng/mL) compared to the control group (30.7 ng/mL), reinforcing the association between anemia and febrile convulsions. Table 7 (Age-wise Distribution of Iron Deficiency Anemia in Children with Febrile Convulsion) shows that iron deficiency anemia was more prevalent in younger age groups, particularly in children aged 1-3 years. Table 8 (Family History of Febrile Convulsion in Children with and without Iron Deficiency Anemia) indicates that children with both febrile convulsions and iron deficiency anemia were more likely to have a family history of seizures. Table 9 (Gender-based Distribution of Iron Deficiency Anemia in Children with Febrile Convulsion) reveals a slightly higher prevalence of iron deficiency anemia in male children compared to females. Table 10 (Association Between Iron Deficiency Anemia and Fever Duration in Children with Febrile Convulsions) demonstrates that children with iron deficiency anemia had a longer duration of fever before the onset of convulsions. Table 11 (Clinical Characteristics of Children with First Febrile Convulsion by Iron Status) compares seizure severity and temperature in children with and without iron deficiency anemia, showing that children with anemia tend to have more severe seizures and higher temperatures. Finally, Table 12 (Impact of Iron Supplementation on Recurrence of Febrile Convulsions) suggests that iron supplementation significantly reduces the recurrence of febrile convulsions, with only 10% of children receiving iron supplementation experiencing recurrence, compared to 30% in the non-supplemented group. These findings collectively support the hypothesis that iron deficiency anemia is associated with more severe and recurrent febrile convulsions in children, and that addressing iron deficiency may help reduce seizure recurrence.

Discussion

The findings of this study provide significant insights into the association between iron deficiency anemia (IDA) and febrile convulsions in children. The study shows that a substantial proportion of children presenting with their first febrile convulsion had iron deficiency anemia, with 65% of the case group diagnosed with IDA, significantly higher than the 30% observed in the control group. This suggests a possible link between iron deficiency and the occurrence of febrile convulsions, which is consistent with previous studies that have proposed iron deficiency as a risk factor for neurological conditions, including seizures.

One of the notable findings from this study is the correlation between iron deficiency anemia and longer seizure duration. Children with IDA experienced febrile convulsions of a longer duration, with an average of 6.5 minutes compared to 5.2 minutes in children without IDA. This finding could be explained by the role of iron in brain function, including neurotransmitter synthesis and neuronal excitability. Iron plays an essential role in the synthesis of dopamine and serotonin, which are involved in controlling neuronal firing and regulating the brain's response to fever. Deficiency in iron could impair these processes, leading to increased seizure duration in response to febrile stimuli [6].

Furthermore, the study found a higher recurrence rate of febrile convulsions in children with IDA. 35% of children with IDA experienced recurrent convulsions, compared to only 15% in the control group. This higher recurrence rate could be attributed to the persistent effect of iron deficiency on brain function and its possible role in lowering the threshold for seizure activity. Iron deficiency is known to alter immune responses and increase the susceptibility to infections, which could further contribute to recurrent febrile convulsions, as infections are a common trigger for seizures in young children [7,8].

The association between lower serum ferritin levels and the occurrence of febrile convulsions is another key finding of this study. Ferritin, which is a marker of iron stores in the body, was significantly lower in children with febrile convulsions compared to the control group. This highlights the importance of adequate iron stores for maintaining normal brain function and preventing seizures. A deficiency in iron may lead to compromised immune function, increasing the likelihood of infections that trigger febrile seizures [9,10].

Additionally, the study found that children with IDA were more likely to have a family history of febrile convulsions. This suggests that genetic factors may also play a role in the occurrence of febrile convulsions, in addition to environmental factors such as iron deficiency. The combination of a genetic predisposition and an environmental trigger such as iron deficiency could increase the risk of febrile convulsions in susceptible children [11].

Interestingly, iron supplementation was shown to reduce the recurrence of febrile convulsions in children with IDA. Only 10% of children receiving iron supplementation experienced recurrence,

compared to 30% of children who did not receive supplementation. This supports the idea that correcting iron deficiency may help reduce the incidence and recurrence of febrile convulsions, particularly in children who are already at risk due to low iron levels. It also underscores the potential benefits of early identification and treatment of iron deficiency in preventing not only iron-related health issues but also neurological complications such as febrile seizures [12,13].

In contrast, the study also highlights some of the challenges in diagnosing and managing iron deficiency anemia in children, particularly in rural and underserved areas where access to diagnostic testing and nutritional supplements may be limited. Socioeconomic factors, including poor nutrition and limited access to healthcare, may contribute to the high prevalence of both iron deficiency and febrile convulsions in these populations. Public health interventions that address both iron deficiency and febrile convulsions could play a critical role in reducing the burden of these conditions in young children.

The findings of this study have important clinical implications. Pediatricians should consider screening for iron deficiency anemia in children who present with febrile convulsions, particularly in regions where the prevalence of anemia is high. Early identification and correction of iron deficiency may not only improve overall health outcomes but could also help in reducing the severity and recurrence of febrile convulsions. Iron supplementation could be a simple and cost-effective intervention to reduce the burden of febrile seizures, especially in resource-limited settings.

Despite these important findings, the study has some limitations. The retrospective design relies on existing medical records, which may lead to incomplete data for some patients. The study is also limited to a single tertiary care center, and the results may not be generalizable to other settings or populations. Future prospective studies with larger sample sizes and multi-center participation could provide more robust evidence of the relationship between iron deficiency and febrile convulsions.

Conclusion:

This study establishes a significant association between iron deficiency anemia and the occurrence of first febrile convulsions in children. Children with IDA were found to have longer seizure durations, higher rates of recurrence, and lower serum ferritin levels. The findings suggest that addressing iron deficiency may help reduce the incidence and recurrence of febrile convulsions, highlighting the importance of early diagnosis and treatment of anemia. Iron supplementation appears to be an effective strategy for reducing recurrence, particularly in children with IDA. These findings emphasize the need for increased awareness and intervention to prevent and manage iron deficiency in pediatric populations, especially in regions with a high prevalence of both iron deficiency and febrile convulsions.

References

1. Bidabadi E, Mashouf M. Association between iron deficiency anemia and first febrile convulsion: A case-control study. Seizure. 2009 Jun;18(5):347-51. doi: 10.1016/j.seizure.2009.01.008. Epub 2009 Feb 15. Erratum in: Seizure. 2021 Feb;85:155. doi: 10.1016/j.seizure.2020.12.011. PMID: 19223207.
2. Papageorgiou V, Vargiami E, Kontopoulos E, Kardaras P, Economou M, Athanassiou-Mataxa M, Kirkham F, Zafeiriou DI. Association between iron deficiency and febrile seizures. Eur J Paediatr Neurol. 2015 Sep;19(5):591-6. doi: 10.1016/j.ejpn.2015.05.009. Epub 2015 Jun 12. PMID: 26112262.
3. Jadhav R, Pande V, Garud B, Mane S. Association of Iron Deficiency Anaemia With the First Episode of Febrile Seizure in Children. Cureus. 2024 Nov 21;16(11):e74129. doi: 10.7759/cureus.74129. PMID: 39712732; PMCID: PMC11662512.
4. Bidabadi E, Mansouri M, Mashouf M. Corrigendum to "Association between iron deficiency anemia and first febrile convulsion: A case-control study" [Seizure: Eur J Epilep 18 (2009) 347-351]. Seizure. 2021 Feb;85:155. doi: 10.1016/j.seizure.2020.12.011. Epub 2021 Jan 5. Erratum for: Seizure. 2009 Jun;18(5):347-51. doi: 10.1016/j.seizure.2009.01.008. PMID: 33419656.
5. Ghasemi F, Valizadeh F, Taee N. Iron-deficiency Anemia in Children with Febrile Seizure: A Case-Control Study. Iran J Child Neurol. 2014 Spring;8(2):38-44. PMID: 24949050; PMCID: PMC4058064.
6. Jang HN, Yoon HS, Lee EH. Prospective case control study of iron deficiency and the risk of febrile seizures in children in South Korea. BMC Pediatr. 2019 Sep 4;19(1):309. doi: 10.1186/s12887-019-1675-4. PMID: 31484495; PMCID: PMC6724315.
7. Fallah R, Tirandazi B, Akhavan Karbasi S, Golestan M. Iron deficiency and iron deficiency anemia in children with febrile seizure. Iran J Ped Hematol Oncol. 2013;3(1):200-3. Epub 2013 Jan 22. PMID: 24575264; PMCID: PMC3915443.
8. Fallah R, Tirandazi B, Ferdosian F, Fadavi N. Iron deficiency and iron deficiency anemia in children with first attack of seizure and on healthy control group: a comparative study. Iran

J Child Neurol. 2014 Summer;8(3):18-23. PMID: 25143769; PMCID: PMC4135276.
9. Daoud AS, Batieha A, Abu-Ekteish F, Gharaibeh N, Ajlouni S, Hijazi S. Iron status: a possible risk factor for the first febrile seizure. Epilepsia. 2002 Jul;43(7):740-3. doi: 10.1046/j.1528-1157.2002.32501.x. PMID: 12102677.
10. Vaswani RK, Dharaskar PG, Kulkarni S, Ghosh K. Iron deficiency as a risk factor for first febrile seizure. Indian Pediatr. 2010 May;47(5):437-9. doi: 10.1007/s13312-010-0080-8. Epub 2009 Sep 3. PMID: 19736364.
11. Naveed-ur-Rehman, Billoo AG. Association between iron deficiency anemia and febrile seizures. J Coll Physicians Surg Pak. 2005 Jun;15(6):338-40. PMID: 15924837.
12. İpek R, Makharoblidze K, Polat BG, Direk MÇ, Yıldırım DD, Kömür M, Okuyaz Ç. Developmental evaluation in children experiencing febrile convulsions. Turk J Pediatr. 2021;63(4):602-611. doi: 10.24953/turkjped.2021.04.007. PMID: 34449142.
13. Kumari PL, Rajamohanan K, Krishnan ASA. Risk Factors of First Episode Simple Febrile Seizures in Children Aged 6 Month to 5 Year: A Case Control Study. Indian Pediatr. 2022 Nov 15;59(11):871-874. PMID: 36370015.