

**Role of Iron Deficiency Anemia in Children with Febrile Seizures**Archana Singh<sup>1</sup>, Arunabh Kumar<sup>2</sup>, Binoy Shankar<sup>3</sup><sup>1,2</sup>Senior Resident, Department of Pediatrics, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar<sup>3</sup>Assistant Professor, Department of Pediatrics, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar

Received: 11-05-2023 / Revised: 09-06-2023 / Accepted: 08-07-2023

Corresponding author: Dr. Arunabh Kumar

Conflict of interest: Nil

**Abstract:****Background:** The febrile seizure (FS), which affects 3-4% of children under the age of five, is a prevalent cause of seizures in young children. The most prevalent micronutrient shortage in the world, iron deficiency, has been linked to febrile seizures. The purpose of this study is to ascertain how frequently children with febrile seizures have iron deficiency anemia.**Methods:** From May 2022 to October 2022, 180 patients in the pediatrics department of the SKMCH in Muzaffarpur, Bihar, participated in this descriptive cross-sectional study.**Results:** Hemoglobin levels were  $10.33 \pm 2.44$  g/dl and mean age was  $1.44 \pm 0.988$  years. 53 men (58.9%) and 37 women (41.1%) were present.**Conclusion:** Anemia from iron deficiency affects more than half of the children who experience febrile seizures.**Keywords:** Iron deficiency anemia, febrile seizures, epilepsy, and children.This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

When a child under the age of five has a temperature of 38°C or greater without a brain infection or metabolic imbalance present with seizure, it is referred to as having febrile seizures.[1,2] Simple febrile seizures, also known as generalized tonic clonic seizures, last less than 15 minutes.[3] Complex febrile seizures can be identified by their focal location, short duration (less than 15 minutes), and recurrence within 24 hours.[4] Status epilepticus is a different condition that causes seizures to last longer than 30 minutes.[5] Due to its high occurrence in children under the age of five and its recurrent nature, febrile seizures are a significant challenge in pediatric practice. Recent years have seen an increase in public awareness of febrile seizure consequences.[6]

Children between the ages of 6 months and 5 years' experience febrile seizures at a rate of 2-5% in Europe, while it is greater in Asian children (5-10%).[7,8]. The risk of aspiration and psychological damage to both parents and children are issues related to this illness.[9] The most prevalent disorder in which the body does not have enough mineral iron is iron deficiency anemia. Up to 50% of preschoolers in impoverished nations suffer from iron deficiency anemia.[10,11] Both

prevention and treatment of iron deficiency anemia are simple. Iron is necessary for the creation of hemoglobin and the enzymes involved in neurochemical processes. Attention deficit, impaired memory, learning disabilities, slowed motor activity, and behavioral instability are characteristics of iron deficiency anemia.[13]

In children under the age of five, literature has shown a strong correlation between iron deficiency anemia and febrile seizures.[1,14] The suggested explanation is that a child's seizure threshold may change as a result of iron shortage. According to 10 studies, patients with febrile seizures frequently had an iron deficiency, with 63% in India and 51.3% in Iran [1]. The goal of this study was to determine how frequently children with febrile seizures have iron deficiency anemia. This study will assist in supplying local data on this crucial feature of iron deficiency anemia in children with febrile seizures as there are no local data currently available. The therapy and prevention of febrile seizures will benefit from the fact that iron deficiency anemia is preventable and treated.

**Material and Methods**

From May 2022 to October 2022, 180 patients were used in this descriptive cross-sectional study

at the Department of Pediatrics, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar, using a consecutive non-probability sampling technique. After explaining the objectives and advantages of the study to the participants' parents, verbal informed agreement was acquired.

Using the WHO software and a published proportion of 63% iron deficiency anemia in febrile seizures at a 95% confidence level and 10% absolute precision, the sample size was calculated to be 180.<sup>9</sup> The study included both male and female children with febrile seizures, ranging in age from 6 months to 5 years. Children with thalassemia, metabolic conditions, and intracranial infections were excluded. A single trained pathologist with more than five years of experience conducted laboratory tests such as hemoglobin level, red cell distribution width, iron deficiency anemia, and serum ferritin. If children's hemoglobin value was less than 10 g/dl, red cell distribution width was larger than 16%, and their serum ferritin level was less than 7 ng/ml, they were diagnosed with iron deficiency anemia. Age, gender, hemoglobin level, red cell distribution width, serum ferritin, and the existence of iron deficiency anemia were the participant's collected

data. In order to control confounders and bias in the study outcomes, strict inclusion criteria were adhered to. SPSS 22 was used to analyze the data. Age and hemoglobin were quantitative variables whose mean and standard deviation were computed.

Frequency and percentage were calculated for categorical data like category of ferritin, red cells distribution width, gender and presence of iron deficiency anemia. Iron deficiency anemia was stratified by age and gender to see effect modification by using chisquare test at  $P \leq 0.05$  to be level of significance. Children with thalassemia, metabolic conditions, and intracranial infections were excluded. Age, gender, hemoglobin level, red cell distribution width, serum ferritin, and iron deficiency anemia were all noted for the youngsters.

### Results

The study participants ranged in age from 6 months to 4 years, with a mean age of  $1.44 \pm 0.988$ . The range of hemoglobin levels was 6 to 15 g/dl, with a mean of  $10.33 \pm 2.44$  g/dl. The age range with the highest frequency ( $n=114$ , 63.33%) and lowest frequency ( $n=26$ , 14.44%) was 1-2 years.(Table-1).

**Table 1: Age Distribution of the study patients**

Age group	No. of patients	Percentage
Less than 1 year	40	22.22%
1-2 years	114	63.33%
3-4 years	26	14.44%

There were 41 women and 106 men (58.9% of the total). Hemoglobin levels were below 10 g/dl in the majority of the youngsters ( $n=102$ , 56.7%). Red cell distribution width in 102 children is  $\geq 16\%$  (56.7%). The percentage of people with serum ferritin levels  $\leq 7$  ng/ml was 55.6% in 100 and 44.4% in 80. There was an iron deficit in 106 individuals (58.9%). (Table 2).

**Table 2: Prevalence of gender, hemoglobin, red cell distribution, serum ferritin and iron deficiency anemia**

Variables		No. of patients	Percentage
Gender	• Male	106	58.9%
	• Female	74	41.1%
Hemoglobin	• $<10$ g/dl	102	56.7%
	• $>10$ g/dl	78	43.3%
Red cells distribution width	• 16%	78	43.3%
	• $\geq 16\%$	102	56.7%
Serum ferritin	• $\leq 7$ ng/ml	100	56.6%
	• $>7$ ng/ml	80	44.4%
Iron deficiency Anemia	• Yes	106	58.9%
	• No	74	41.1%

Females (62.2%) had a greater prevalence of iron deficient patients with febrile seizures than men (56.6%), however the difference was not statistically significant ( $P=0.598$ ). The details are shown in table 3.

**Table 3: Iron deficiency anemia in febrile seizure stratified by gender**

Gender	Yes		No		p-value
	No. of patients	Percentage	No. of patients	Percentage	
Male	60	56.6%	46	43.4%	0.598
Female	46	62.2%	28	37.8%	

In febrile seizure and age groups was not statistically significant ( $P=0.359$ ). The detailed statistics are shown in table 4.

**Table 3: Iron deficiency anemia in febrile seizure stratified by Age group**

Age group	Yes		No		p-value
	No. of patients	Percentage	No. of patients	Percentage	
Less than 1 year	22	55.0%	18	45.0%	0.359
1-2 years	64	56.1%	50	43.9%	
3-4 years	20	76.9%	6	23.1%	

## Discussion

This study sought to ascertain how frequently children presenting with febrile seizures have iron deficiency anemia. Our main findings were that 58.9% of children with febrile seizures had iron deficiency anemia, and there was no statistically significant correlation between age ( $P=0.359$ ) or gender ( $P=0.598$ ) and iron deficiency anemia in children with febrile seizures. In our study, there were 106 (58.9%) males and 74 (41.1%) females.

We employed the consecutive sampling technique and included all kids who had febrile seizures. A prior rat model study looked into whether there is a genetic component to the male predominance in febrile seizures.[15] According to a study done in Iran, more men (66%) than women (34%) get febrile seizures.[1] Another study from Karachi, Pakistan, found that febrile seizures were more common among men.16 Other researchers reported similar results.[17,18] Our results showed that the study average age was  $1.44 \pm 0.988$  years, ranging from 6 months to 4 years.

An earlier examination in India on febrile seizures in children identified cases of similar ages.[16] According to the current study, children who experienced febrile seizures had a mean hemoglobin level of  $10.33 \pm 2.44$  g/dl on average. According to a prior study conducted in Iran, children who experienced febrile seizures had mean hemoglobin levels of  $11.55 \pm 1.34$  g/dl.[1] Another study from Karachi, Pakistan, found that children experiencing febrile seizures had mean hemoglobin levels of  $9.97 \pm 0.29$  g/dl.[19] These findings are almost comparable to the present research.

According to our research, 106 (58.1%) of the kids with febrile seizures had iron deficiency anemia. In a research on the prevalence of iron deficiency in patients with febrile seizures, Kumari et al.[9] found that 63% of the patients were affected. In a different Iranian study, patients with febrile seizures had an iron deficit 51.3% of the time.[1] These studies bolster our conclusions. As a result of our findings, anemia caused by iron deficiency affects more than half of the children who experience febrile seizures. Therefore, we anticipate a favorable correlation between iron deficiency anemia and febrile seizures (FS). An earlier study conducted in Iran similarly found a correlation between febrile seizures and iron deficiency anemia ( $OR=1.89$ , 95%  $CI=1.04$ ,

5.17).[1] Iron deficiency anemia and FS were positively associated, according to another study conducted in India.[20] A study carried out in Tokiyo, Japan, found a substantial positive relationship between the two disorders ( $OR=1.6$ ,  $P0.0$ ).[19] This work gives us a foundational understanding of the relationship between iron deficiency anemia and febrile seizures, but more case-control studies with rigorous inclusion criteria and large sample sizes are required to fully understand this relationship in our population. Additional rigorous studies are required to determine the etiological significance of iron deficiency in febrile seizures.

## Conclusion

Given the limitations of this study, it may be said that anemia caused by iron deficiency affects more than half of the children who experience febrile seizures. Therefore, when treating kids who are having febrile seizures, clinicians need to be on the lookout for iron deficiency anemia.

## References

- Ghasemi F, Valizadeh F. Iron-deficiency anemia in children with febrile seizure: a case-control study. *Iran J Child Neurol* 2014;8(2):38.
- Kwak BO, Kim K, Kim S-N, Lee R. Relationship between iron deficiency anemia and febrile seizures in children: A systematic review and meta-analysis. *Seizure*. 2017; 52:27-34.
- Millichap JJ, Millichap J. Clinical features and evaluation of febrile seizures. *Up To Date* Waltham, MA Publisher. 2019.
- Dreier JW, Li J, Sun Y, Christensen J. Evaluation of long-term risk of epilepsy, psychiatric disorders, and mortality among children with recurrent febrile seizures: a national cohort study in Denmark. *J Am Med Assoc Pediatr*. 2019;173(12):1164-70.
- Sculier C, Gaínza-Lein M, Sanchez Fernandez I, Loddenkemper T. Longterm outcomes of status epilepticus: A critical assessment. *Epilepsia*. 2018; 59:15569.
- Leung AK, Hon KL, Leung TN. Febrile seizures: an overview. *Drugs in context*. 2018; 7:31-9.
- Improvement SCoQ, Management SoFS. Febrile seizures: clinical practice guideline for the long-term management of the child with

- simple febrile seizures. *Pediatr.* 2008; 121(6):1281-6.
8. Paul SP, Seymour M, Flower D, Rogers E. Febrile convulsions in children. *Nurs Child Young People.* 2015; 27(5):14.
  9. Kumari PL, Nair M, Nair S, Kailas L, Geetha S. Iron deficiency as a risk factor for simple febrile seizures-a case control study. *Indian Pediatr.* 2012; 49(1):17-9.
  10. Zareifar S, Hosseinzadeh HR, Cohan N. Association between iron status and febrile seizures in children. *Seizure.* 2012;21(8):603-5.
  11. Sherjil A, us Saeed Z, Shehzad S, Amjad R. Iron deficiency anaemia—a risk factor for febrile seizures in children. *J Ayub Med Coll Abbottabad.* 2010; 22(3):71-3.
  12. Zucca FA, Segura-Aguilar J, Ferrari E, Muñoz P, Paris I, Sulzer D, et al. Interactions of iron, dopamine and neuromelanin pathways in brain aging and Parkinson's disease. *Prog Neurobiol.* 2017; 155:96-119.
  13. Besarab A, Hemmerich S. Iron-Deficiency Anemia. *Management of Anemia: Springer;* 2018;11-29.
  14. Billoo A. Association between iron deficiency anemia and febrile seizures. *J Coll Physician Surg.* 2005; 15(6):338-40.
  15. Lemmens EM, Lubbers T, Schijns OE, Beuls EA, Hoogland G. Gender differences in febrile seizure-induced proliferation and survival in the rat dentate gyrus. *Epilepsia.* 2005; 46(10):1603-12.
  16. Habib Z, Akram S, Ibrahim S, Hasan B. Febrile seizures: factors affecting risk of recurrence in Pakistani children presenting at the Aga Khan University Hospital. *J Pak Med Assoc.* 2003; 53(1).
  17. Gourabi HE, Bidabadi E, Cheraghalipour F, Aarabi Y, Salamat F. Febrile seizure: demographic features and causative factors. *Iran J Child Neurol.* 2012; 6(4):33.
  18. Abbaskhanian A, VahidShahi K, Parvinnezhad N. The association between iron deficiency and the first episode of febrile seizure. *Int J Pediatr.* 2010; 2010(1):862897.
  19. Netayahu F, Sukiyama Q, et al. Association of iron deficiency anemia in children with febrile convulsions. *Jap. J Neurol Sci.* 2016;11(3):3-8.
  20. Vaswani RK, Dharaskar PG, Kulkarni S, Ghosh K. Iron deficiency as a risk factor for first febrile seizure. *Indian Pediatr.* 2010;47(5):437-9.