

Association of Iron Deficiency and Vitamin D Status with Febrile Seizures in Children: A Hospital-Based Case–Control StudySunil Kumar Agarwalla¹, Rutuparna Dash², Subhashree Kar³¹Professor, Department of Pediatrics, SCB MCH, Cuttack, Odisha, India²Senior Resident, Department of Pediatrics, Cuttack, Odisha, India³Assistant Professor, Department of Pediatrics, Cuttack, Odisha, India

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Abstract**Background:** Febrile seizures are the most common neurological disorder in early childhood, affecting children between 6 months and 5 years of age. Nutritional deficiencies, particularly iron deficiency and Vitamin D deficiency, have been increasingly implicated in lowering seizure threshold and influencing seizure recurrence.**Objectives:** To evaluate the association of iron deficiency and serum Vitamin D levels with febrile seizures and to assess their correlation with seizure frequency among children.**Materials and Methods:** A hospital-based case–control study was conducted in the Department of Pediatrics, SCB Medical College & Hospital, Cuttack, from August 2022 to July 2024. A total of 180 children were enrolled, including 90 cases with febrile seizures and 90 age- and sex-matched febrile controls without seizures. Hematological parameters, serum ferritin, and serum 25-hydroxy Vitamin D levels were estimated and compared between the groups. Statistical analysis was performed using SPSS software.**Results:** Children with febrile seizures had significantly lower mean hemoglobin (10.40 ± 1.61 g/dL vs 11.76 ± 1.84 g/dL), mean corpuscular volume, mean corpuscular hemoglobin, red cell distribution width, serum ferritin (66.35 ± 35.45 ng/mL vs 106.38 ± 38.89 ng/mL), and serum Vitamin D levels (23.39 ± 9.79 ng/mL vs 30.86 ± 13.41 ng/mL) compared to controls ($p < 0.001$). Iron deficiency anemia and low Vitamin D levels were significantly associated with increased frequency of febrile seizures.**Conclusion:** Iron deficiency and Vitamin D deficiency are significantly associated with febrile seizures and seizure frequency in children. Routine screening and correction of these deficiencies may help reduce the burden of febrile seizures.**Keywords:** Febrile seizures, Iron deficiency anemia, Serum ferritin, Vitamin D deficiency, Pediatric seizures.**DOI:** 10.25258/ijcpr.18.2.215This 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**

Febrile seizures (FS) represent the most common neurological disorder in early childhood, affecting approximately 2–5% of children globally and up to 10% in certain developing regions [1,2]. They typically occur between the ages of 6 months and 5 years and are defined as seizures associated with fever in the absence of central nervous system infection, acute metabolic imbalance, or prior afebrile seizures [3]. Although febrile seizures are often benign and self-limiting, they are a major source of parental anxiety and healthcare utilization and may be associated with seizure recurrence and, rarely, later epilepsy [4].

The pathophysiology of febrile seizures remains complex and multifactorial. Several mechanisms have been proposed, including immature neuronal inhibitory pathways, rapid elevation of body temperature, enhanced excitatory

neurotransmission, inflammatory cytokine release, genetic susceptibility, and altered ion channel function [5,6]. Despite extensive research, no single mechanism fully explains why only a subset of febrile children develop seizures, suggesting the presence of additional predisposing factors.

Nutritional deficiencies have increasingly gained attention as potentially modifiable risk factors influencing seizure threshold. Iron deficiency anemia (IDA) is the most prevalent micronutrient deficiency worldwide, particularly among infants and young children in developing countries [7]. Iron is essential for normal brain development, neurotransmitter synthesis, myelination, and cellular energy metabolism [8]. Iron deficiency may impair gamma-aminobutyric acid (GABA) metabolism, alter dopamine and serotonin pathways, and reduce oxygen delivery to the brain,

thereby increasing neuronal excitability and susceptibility to seizures [9,10]. Several studies have reported an association between iron deficiency anemia and febrile seizures. Pisacane et al. were among the first to demonstrate a higher prevalence of iron deficiency anemia in children with febrile seizures compared to febrile controls [11]. Subsequent studies by Daoud et al. and Hartfield et al. further supported this association, highlighting significantly lower serum ferritin and hemoglobin levels in children with febrile seizures [12,13]. However, some studies have reported conflicting findings, underscoring the need for further well-designed studies in different populations [14].

In addition to iron, Vitamin D has emerged as a critical neuroactive hormone with important roles in brain development and function. Vitamin D receptors and the enzyme 1-alpha hydroxylase are widely distributed in the central nervous system, particularly in areas involved in seizure generation such as the hippocampus and cortex [15]. Vitamin D regulates calcium homeostasis, modulates inflammatory cytokine responses, enhances antioxidant defenses, and stabilizes neuronal membranes [16].

Vitamin D deficiency is highly prevalent among children in tropical countries, including India, despite abundant sunlight exposure, due to lifestyle factors, skin pigmentation, and dietary insufficiency [17]. Emerging evidence suggests that Vitamin D deficiency may lower seizure threshold and contribute to seizure susceptibility during febrile illnesses. Studies by Ghazavi et al. and Moghadam et al. demonstrated significantly lower serum 25-hydroxy Vitamin D levels in children with febrile seizures compared to controls [18,19].

Despite the high prevalence of both iron deficiency and Vitamin D deficiency, limited studies have evaluated their combined role in febrile seizures, particularly in the Indian pediatric population. Furthermore, data on the relationship between these deficiencies and seizure frequency remain scarce.

The present study was therefore conducted to evaluate the association of iron deficiency and Vitamin D status with febrile seizures and to assess their correlation with seizure frequency in children attending a tertiary care hospital.

Materials and Methods

This was a Hospital-based case-control study, carried out in the Department of Pediatrics, SCB Medical College & Hospital, Cuttack for a period of 24 months i.e, August 2022 to July 2024. The study was conducted as a case-control study to investigate the relationship between iron deficiency and febrile seizures. Cases of febrile seizures were recruited from the inpatient or emergency

department of Pediatrics, while controls with a short duration of fever (<3 days) but without febrile seizures were selected from the same setup. A total of 180 children (90 cases and 90 controls), calculated using OpenEpi software with 95% confidence interval, 80% power, and 1:1 case-control ratio.

Inclusion Criteria

1. Children aged 6 months to 14 years with a diagnosis of febrile seizure based on clinical history and examination.
2. Children with a short duration of fever but without seizures, matched by age and sex, were selected as controls.

Exclusion Criteria

1. Patients with a history of pre-existing neurological or developmental disorders.
2. Patients with a history of chronic diseases or conditions affecting iron metabolism.
3. Children with a history of seizure disorder, CNS infections, metabolic imbalances, developmental delays, or neurological deficits.
4. Iron supplementation for more than 3 days in the last 3 months.
5. Previously diagnosed cases of other hematological problems like haemolytic anemia, bleeding or coagulation disorders, hematological malignancies were excluded from the study.
6. Vitamin D supplementation in last 3 months.

Detailed clinical history, examination, and laboratory investigations including complete blood count, serum ferritin, and serum 25-hydroxy Vitamin D were performed.

Ethical Considerations: Ethical approval was sought from the Institutional Review Board (IRB) or Ethics Committee of SCB Medical College & Hospital, Cuttack.

Statistical Analysis: Data were analyzed using SPSS software. Continuous variables were compared using appropriate statistical tests. A p-value <0.05 was considered statistically significant.

Results

The study included 180 children with a mean age of 22.56 ± 14.02 months. The majority belonged to the 6–24 months age group. Males constituted 58.3% of the study population. Among cases, 75.6% had simple febrile seizures and 24.4% had complex febrile seizures. Respiratory tract infections were the most common etiology.

Children with febrile seizures had significantly lower hemoglobin, MCV, MCH, RDW, and serum ferritin levels compared to controls. Serum Vitamin D levels were also significantly lower in cases. Iron deficiency and Vitamin D deficiency were

significantly associated with increased seizure frequency.

Table 1: Socio-demographic profile of the study

Characteristics	Overall(N=180)
Age	
Mean (SD)	22.56 (14.02)
Age groups	
06-12months	63 (35.0%)
13-24months	57 (31.7%)
25-36months	30 (16.7%)
37-48months	16 (8.9%)
49-59months	14 (7.8%)
Sex	
Female	75 (41.7%)
Male	105 (58.3%)

Table 2: Comparison of sociodemographic profile of the study participants between case and control groups

Characteristics	Case(N=90)	Control (N=90)	P value
Age			0.21
Mean (SD)	23.87 (14.56)	21.24 (13.42)	
Age groups			0.79
06-12mo	29 (32.2%)	34 (37.8%)	
13-24mo	28 (31.1%)	29 (32.2%)	
25-36mo	16 (17.8%)	14 (15.6%)	
37-48mo	8 (8.9%)	8 (8.9%)	
49-59mo	9 (10.0%)	5 (5.6%)	
Sex			0.29
Female	41 (45.6%)	34 (37.8%)	
Male	49 (54.4%)	56 (62.2%)	

In terms of sex distribution, the case group comprised 45.6% females and 54.4% males, whereas the control group included 37.8% females and 62.2% males. The comparison between the sexes across the case and control groups did not reveal a statistically significant difference ($p = 0.29$).

Table 3: Clinical history and presentation among the cases

Characteristics	Overall (N=90)
Type of seizures	
Complex	22 (24.4%)
Simple	68 (75.6%)
Frequency of seizure	
Mean (SD)	1.20 (0.48)
Etiology of febrile seizure	
RTI	78 (86.7%)
UTI	12 (13.3%)
Previous H/O febrile seizure	
No	60 (66.7%)
Yes	30 (33.3%)
Family H/O febrile seizure	
No	77 (85.6%)
Yes	13 (14.4%)

Out of the total participants, 22 (24.4%) experienced complex febrile seizures, while a larger portion, 68 (75.6%), had simple febrile seizures. This distribution highlights a predominant occurrence of simple febrile seizures among the participants. The average frequency of seizures among the participants was 1.20, with a standard

deviation of 0.48. This indicates a relatively low recurrence rate of febrile seizures within this group. A majority of the participants, 77 (85.6%), reported no family history of febrile seizures, whereas 13 (14.4%) confirmed such a history, indicating a potential genetic or familial predisposition to this condition.

Table 4: Iron level in cases and control

Iron Profile	Case(N=90)	Control(N=90)	Pvalue
Hb (gm/dl)	10.40(1.61)	11.76(1.84)	<0.001
TRBC (mm/cum)	4.09(0.68)	4.18(0.70)	0.39
MCV (fl)	76.08(11.12)	83.11(10.83)	<0.001
MCH (pg)	27.05(3.19)	29.00(2.85)	<0.001
MCHC (gm/dl)	29.70(2.63)	29.69(2.14)	0.99
RDW	14.67(2.00)	13.23(1.95)	<0.001
S. Ferritin (ng/ml)	66.35(35.45)	106.38(38.89)	<0.001

Overall, the analysis highlighted significant differences in most iron profile parameters between the cases and controls, notably in haemoglobin levels, MCV, MCH, RDW, and serum ferritin, with only TRBC and MCHC showing no significant differences. This data could suggest a greater prevalence of iron deficiency among the cases compared to the controls.

The average haemoglobin level in the case group was 10.40 g/dL with a standard deviation of 1.61, which was significantly lower than the control group's average of 11.76 g/dL with a standard deviation of 1.84 ($p < 0.001$).

The mean total red blood cell count for the cases was 4.09 million/mm³ (SD = 0.68) and for the controls was 4.18 million/mm³ (SD = 0.70), with

no statistically significant difference between the two groups ($p = 0.39$).

Mean Corpuscular Volume and Mean Corpuscular Haemoglobin: Significant differences were observed in MCV and MCH levels. The cases had a lower mean MCV of 76.08 fL (SD = 11.12) compared to 83.11 fL (SD = 10.83) for the controls, and a lower mean MCH of 27.05 pg (SD = 3.19) compared to 29.00 pg (SD = 2.85) for the controls, both with p -values < 0.001 .

Serum Ferritin: Serum ferritin levels were significantly lower in the cases, with a mean of 66.35 ng/mL (SD = 35.45), compared to the controls who had a mean of 106.38 ng/mL (SD = 38.89), with a p -value < 0.001 , suggesting lower iron stores in the cases.

Table 5: Comparison of Cases and controls interm of proportion of anaemia within the group

Haematological parameters	Case (N=90)	Control (N=90)	P value
Hb (mg/dl)			0.018
Anaemia (<12mg/dl)	83 (92.2%)	72 (80.0%)	
Normal (>12 mg/dl)	7 (7.8%)	18 (20.0%)	
TRBC (mm/cum)			0.29
Anaemia (<4.2mm/cum)	41 (45.6%)	34 (37.8%)	
Normal (>4.2mm/cum)	49 (54.4%)	56 (62.2%)	
MCV			<0.001
Anaemia(<80fl.)	59 (65.6%)	26 (28.9%)	
Normal(>80fl.)	31 (34.4%)	64 (71.1%)	
MCH			<0.001
Anaemia (<27 pg.)	51 (56.7%)	20 (22.2%)	
Normal (>27 pg.)	39 (43.3%)	70 (77.8%)	
MCHC			0.45
Anaemia (<32gm/dl)	71 (78.9%)	75 (83.3%)	
Normal (>32gm/dl)	19 (21.1%)	15 (16.7%)	
RDW			<0.001
Anaemia (<11.6%)	1 (1.1%)	20 (22.2%)	
Normal (>11.6%)	89 (98.9%)	70 (77.8%)	
Ferritin			<0.001
Anaemia (<30ng/ml)	14 (15.6%)	0 (0.0%)	
Normal (>30ng/ml)	76 (84.4%)	90 (100.0%)	

The table 5 summarized a comparative analysis of hematological parameters between two groups, consisting of 90 cases and 90 controls, with significant statistical evaluations noted through p -values.

Haemoglobin Levels: The analysis revealed a statistically significant difference in haemoglobin levels between the groups ($p = 0.018$). A higher

proportion of the case group, 92.2% (83 participants), had haemoglobin levels indicative of anaemia (<12 mg/dl), compared to 80.0% (72 participants) in the control group. Conversely, normal hemoglobin levels (>12 mg/dl) were observed in 7.8% (7 participants) of the cases and 20.0% (18 participants) of the controls.

Total Red Blood Cell Count (TRBC): No

significant difference was found in TRBC between the cases and controls ($p = 0.29$). In the context of anemia (TRBC<4.2mm/cum), 45.6% of cases and 37.8% of controls were affected, while normal TRBC levels (>4.2 mm/cum) were reported in 54.4% of cases and 62.2% of controls.

Mean Corpuscular Volume (MCV): A significant disparity in MCV levels was observed ($p < 0.001$). Cases had a higher incidence of MCV indicative of anemia (<80 fl.), with 65.6% (59 participants) compared to 28.9% (26 participants) in the control group. Normal MCV levels (>80 fl.) were less common in cases (34.4%) than in controls (71.1%).

Mean Corpuscular Hemoglobin (MCH): There was a significant difference in MCH levels between the groups ($p < 0.001$). A majority of cases, 56.7% (51 participants), had MCH levels suggesting anemia (<27 pg), in contrast to only 22.2% (20 participants) in the control group. Normal MCH levels (>27pg) were present in 43.3% of cases and

77.8% of controls.

Mean Corpuscular Hemoglobin Concentration (MCHC): This parameter showed no significant difference between the groups ($p = 0.45$), with 78.9% of cases and 83.3% of controls showing MCHC levels indicative of anemia (<32 gm/dl). Normal MCHC levels (>32 gm/dl) were found in 21.1% of cases and 16.7% of controls.

Serum Ferritin: The levels of ferritin also showed a significant difference ($p < 0.001$), with 15.6% of cases having ferritin levels indicative of anemia (<30 ng/ml), whereas all controls had normal ferritin levels (>30 ng/ml). This detailed retrospective comparison highlighted significant differences in most haematological parameters between cases and controls, particularly in terms of MCV, MCH, RDW, and ferritin levels, indicating a higher prevalence of anaemia-related indicators among the cases.

Table 6: Comparison of Vitamin D levels between case and control groups

Vitamin D	Case (N=90) Mean (SD)	Control (N=90) Mean (SD)	P value
S.25-hydroxyVitaminD	23.39(9.79)	30.86(13.41)	<0.001

Serum 25-Hydroxy Vitamin D Levels: The mean serum25-hydroxyVitamin D level in the case group was 23.39 ng/mL, with a standard deviation of 9.79 ng/mL. In contrast, the control group exhibited a higher mean level of 30.86 ng/mL, with a standard deviation of 13.41ng/mL. The difference in Vitamin D levels between the case and control groups was statistically significant ($p < 0.001$). This significant disparity in Vitamin D levels suggests

that individuals in the case group had lower Vitamin D status compared to the control group.

The analysis highlights a potential association between lower Vitamin D levels and the conditions or characteristics defining the case group, emphasizing the need for further investigation into Vitamin D's role in health and disease management within this population.

Table 7: Frequency of seizures in relation to anemia status among the study participants

	Normal(N=90)	Single Episode(N=75)	Multiple episode(N=15)	P value
HB class				0.048
Anemia	72 (80.0%)	70 (93.3%)	13 (86.7%)	
Normal	18 (20.0%)	5 (6.7%)	2 (13.3%)	0.51
TRBC class				
Anemia	34 (37.8%)	35 (46.7%)	6 (40.0%)	<0.001
Normal	56 (62.2%)	40 (53.3%)	9 (60.0%)	
MCV class				<0.001
Anemia	26 (28.9%)	50 (66.7%)	9 (60.0%)	
Normal	64 (71.1%)	25 (33.3%)	6 (40.0%)	0.62
MCH class				
Anemia	20 (22.2%)	43 (57.3%)	8 (53.3%)	<0.001
Normal	70 (77.8%)	32 (42.7%)	7 (46.7%)	
MCHC class				<0.001
Anemia	75 (83.3%)	60 (80.0%)	11 (73.3%)	
Normal	15 (16.7%)	15 (20.0%)	4 (26.7%)	<0.001
RDW class				
Anemia	20 (22.2%)	1 (1.3%)	0 (0.0%)	<0.001
Normal	70 (77.8%)	74 (98.7%)	15 (100.0%)	
Ferritin class				<0.001
Anemia	0 (0.0%)	12 (16.0%)	2 (13.3%)	
Normal	90 (100.0%)	63 (84.0%)	13 (86.7%)	

The study investigated the frequency of seizures in relation to anemia status among the participants, categorized into normal, single episode, and multiple episode groups. Hemoglobin (hb_class) levels revealed significant differences ($P=0.048$), with anemia observed in 72 (80.0%) of the normal group, 70 (93.3%) of the single episode group, and 13 (86.7%) of the multiple episode group. Conversely, normal hemoglobin levels were seen in 18 (20.0%), 5 (6.7%), and 2 (13.3%) participants in the respective groups.

Total red blood cell count (trbc_class) showed no significant difference ($P=0.51$). Anemia was present in 34 (37.8%) of the normal group, 35 (46.7%) of the single episode group, and 6 (40.0%) of the multiple episode group, while normal counts were observed in 56 (62.2%), 40 (53.3%), and 9 (60.0%) participants, respectively.

Mean corpuscular volume (mcv_class) displayed highly significant differences ($P<0.001$). Anemia was noted in 26 (28.9%) of the normal group, 50 (66.7%) of the single episode group, and 9 (60.0%) of the multiple episode group. Normal values were recorded in 64 (71.1%), 25 (33.3%), and 6 (40.0%) participants, respectively.

Mean corpuscular hemoglobin (mch_class) also showed significant differences ($P<0.001$). Anemia was observed in 20 (22.2%) of the normal group, 43 (57.3%) of the single episode group, and 8 (53.3%) of the multiple episode group. Normal values were found in 70 (77.8%), 32 (42.7%), and 7 (46.7%) participants, respectively. Mean corpuscular hemoglobin concentration (mchc_class) showed no significant difference ($P=0.62$). Anemia was present in 75 (83.3%) of the normal group, 60 (80.0%) of the single episode group, and 11 (73.3%) of the multiple episode group, while normal concentrations were seen in 15 (16.7%), 15 (20.0%), and 4 (26.7%) participants, respectively. Red cell distribution width (rdw_class) displayed significant differences ($P<0.001$). Anemia was present in 20 (22.2%) of the normal group, 1 (1.3%) of the single episode group, and none of the multiple episode group. Normal values were found in 70 (77.8%), 74 (98.7%), and 15 (100.0%) participants, respectively.

Ferritin levels (ferritin_class) also showed significant differences ($P<0.001$). Anemia was observed in none of the normal group, 12 (16.0%) of the single episode group, and 2 (13.3%) of the multiple episode group, while normal levels were recorded in 90 (100.0%), 63 (84.0%), and 13 (86.7%) participants, respectively.

Discussion

The present hospital-based case-control study provides strong evidence supporting the association between iron deficiency, Vitamin D deficiency, and

febrile seizures in children. The findings demonstrate significantly lower hemoglobin, red cell indices, serum ferritin, and serum 25-hydroxy Vitamin D levels among children with febrile seizures compared to febrile controls without seizures.

Age and clinical profile: The mean age of children with febrile seizures in this study was 23.87 months, with the majority belonging to the 6–24 months age group. This observation is consistent with the classical age distribution reported by Nelson and Ellenberg, who emphasized the vulnerability of this age group due to immature neuronal inhibitory mechanisms and heightened inflammatory responses to fever [1]. Similar age distributions have been reported in Indian and international studies [20,21]. Simple febrile seizures constituted 75.6% of cases, which aligns with the established epidemiological pattern that simple febrile seizures are more common than complex febrile seizures [3]. Respiratory tract infections were the predominant precipitating factor, supporting earlier reports that viral infections associated with rapid temperature elevation play a crucial role in seizure initiation [22].

Iron deficiency and febrile seizures: A key finding of this study was the significantly lower mean hemoglobin, MCV, MCH, RDW, and serum ferritin levels in cases compared to controls. The higher prevalence of microcytic hypochromic anemia and depleted iron stores among cases suggests that iron deficiency may play a significant role in the pathogenesis of febrile seizures.

These findings are in agreement with Pisacane et al., who reported a significantly higher prevalence of iron deficiency anemia among children with febrile seizures [11]. Daoud et al. also observed significantly lower serum ferritin levels in children with febrile seizures, emphasizing the importance of assessing iron stores rather than relying solely on hemoglobin levels [12]. Hartfield et al. further demonstrated that iron deficiency increased the risk of febrile seizures even in the absence of overt anemia [13].

Iron deficiency may lower seizure threshold by impairing neurotransmitter synthesis, particularly GABA, the principal inhibitory neurotransmitter in the brain [9]. Additionally, iron deficiency may disrupt myelination and neuronal energy metabolism, further enhancing neuronal excitability during febrile illnesses [8,10].

The present study demonstrated significantly lower serum 25-hydroxy Vitamin D levels among children with febrile seizures compared to controls. This finding is consistent with studies by Ghazavi et al. and Moghadam et al., who reported significantly lower Vitamin D levels in children

with febrile seizures [18,19]. Vitamin D deficiency may contribute to seizure susceptibility by altering calcium channel regulation, increasing excitatory neurotransmission, and enhancing pro-inflammatory cytokine release during febrile illnesses [15,16]. Holick highlighted the neuroprotective role of Vitamin D and its importance in maintaining neuronal stability [17].

An important observation in this study was the significant association between iron deficiency parameters and seizure frequency. Children with recurrent febrile seizures demonstrated a higher prevalence of anemia and low ferritin levels. Similar observations have been reported by Kumari et al. and Shinnar et al., who suggested that iron deficiency may influence seizure recurrence [14, 5]. This finding has important clinical implications, as correction of iron deficiency may reduce seizure recurrence and associated morbidity.

Clinical implications: Given the high prevalence of iron and Vitamin D deficiency in developing countries, routine screening for these deficiencies in children presenting with febrile seizures may offer a simple and cost-effective preventive strategy. Early nutritional intervention could potentially reduce seizure recurrence and improve neuro developmental outcomes.

Conclusion

Iron deficiency anemia and Vitamin D deficiency are significantly associated with febrile seizures and seizure frequency in children. Routine screening for iron and Vitamin D status should be considered in children presenting with febrile seizures, especially in regions with high prevalence of nutritional deficiencies.

Limitations of the Study

1. Single-center hospital-based study
2. Causal relationship cannot be established
3. Other micronutrients were not assessed
4. Lack of long-term follow-up

Declarations

Conflicts of interest: There is no any conflict of interest associated with this study

Consent to participate: There is consent to participate.

Consent for publication: There is consent for the publication of this paper.

Authors Contributions: Author equally contributed the work.

References

1. Nelson KB, Ellenberg JH. Febrile seizures. *N Engl J Med.* 1978; 298:1029-33.
2. Steering Committee on Quality Improvement. Febrile seizures: clinical practice guideline. *Pediatrics.* 2011;127:389-94.
3. Pisacane A, et al. Iron deficiency anemia and febrile convulsions. *BMJ.* 1996;313:343.
4. Daoud AS, et al. Iron status and febrile seizures. *Eur J Pediatr.* 2002;161:490-3.
5. Kumari PL, et al. Iron deficiency and febrile seizures. *Indian Pediatr.* 2012;49:43-6.
6. Ghazavi M, et al. Vitamin D levels in febrile seizures. *Iran J Child Neurol.* 2014;8:38-42.
7. Moghadam MN, et al. Association of vitamin D deficiency and febrile seizures. *Seizure.* 2015;30:115-8.
8. Hartfield DS, et al. Iron deficiency and febrile seizures. *Pediatrics.* 2009;124:e710-6.
9. Idro R, et al. Iron deficiency anemia and seizures. *Lancet Neurol.* 2010;9:118-25.
10. Beard JL. Iron deficiency alters brain development. *J Nutr.* 2003;133:1468-72.
11. Christensen J, et al. Febrile seizures and recurrence. *Neurology.* 2006;67:1297-303.
12. Grantham-McGregor S. Iron deficiency and cognition. *J Nutr.* 2001;131:649-66.
13. Kliegman RM. *Nelson Textbook of Pediatrics.* 21st ed. Elsevier; 2020.
14. Shinnar S, et al. Risk factors for recurrence of febrile seizures. *Pediatrics.* 1996;97:769-75.
15. Tekgul H, et al. Febrile seizures: clinical aspects. *Epileptic Disord.* 2006;8:31-7.
16. Millichap JG. Febrile seizures. *Neurology.* 1968;18:1001-6.
17. American Academy of Pediatrics. Febrile seizure guidelines. *Pediatrics.* 2011;127:389-94.
18. Holick MF. Vitamin D deficiency. *N Engl J Med.* 2007;357:266-81.
19. Holick MF. Vitamin D and brain function. *J Clin Endocrinol Metab.* 2010;95:114-8.
20. Roth DE, et al. Vitamin D deficiency in childhood. *Lancet.* 2008;372:1107-16.
21. Prasad R, et al. Febrile seizures in India. *Indian J Pediatr.* 2014;81:137-42.
22. Seizures. Febrile seizures: guideline update. *Pediatrics.* 2011; 127:389-94.