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## **Original Research Article**

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# Study on association of iron status in children with simple febrile seizure and without seizures

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#### **ABSTRACT**

**Background:** Considering the age prevalence of iron deficiency anaemia and febrile convulsion which are the same, the role of iron in the metabolism of neurotransmitters (such as GABA and serotonin) and some enzymes (such as monoaminoxidase and aldehideoxidase), the function of hemoglobin in conveying oxygen to the brain and since fever can exacerbate symptoms that result from anaemia, a relationship between iron deficiency anaemia and febrile convulsions is probable. Thus, the present study was conducted to determine the iron profile in children with simple febrile seizures and febrile children without seizures and also to find out the association between iron levels and simple febrile seizures.

**Methods:** A cross sectional comparative study was conducted among the infants and children aged between 6 months to 6 years with complaints of fever with/ without seizures attending Pediatrics OPD, Sri Siddartha Medical College, Tumkur during the period between 2016 to 2018. Purposive sampling of equal number of children in two study groups were made. Demographic data, seizure details, nature of febrile illness, family history of epilepsy /febrile seizures, temperature at admission and nutritional status were recorded. For laboratory assessment, 2 ml venous blood was drawn and sent for estimation of complete blood count with peripheral smear. Statistical analysis was done using SPSS version 16.

**Results:** Among 112 study participants, 60.7% were anaemic. The indicators of iron deficiency anaemia like Hb%, MCH, TIBC and S. ferritin were associated with febrile seizures and were statistically significant.

Conclusions: Anaemia prevalence in infants and young children is high and was significantly associated with febrile seizures

Keywords: Iron deficiency anaemia, Neurotransmitters, Simple febrile seizures

#### **INTRODUCTION**

Febrile seizures are seizures that occur between the age of 6 and 60 months with a temperature of 38°C (100.4°F) or higher, that are not the result of central nervous system infection and that occur in the absence of a history of prior afebrile seizures. A simple febrile seizure is a primary generalized and tonic-clonic in nature, lasts a few seconds and rarely up to 15 min, is followed by a

brief postictal period of drowsiness, and occurs only once in 24 hr.<sup>1,2</sup> The incidence of febrile convulsions is 2-5% in neurologically healthy child. The peak incidence of febrile seizure is at the age of 14 to 18 months.<sup>2</sup>

Iron deficiency anemia is one of the most prevalent micronutrient deficiencies in young children in India and other parts of the world, and it is strongly associated with persistent cognitive and motor delays even after the anemia and iron deficit have been repaired. Most iron in neonates is in circulating hemoglobin. As the relatively high hemoglobin concentration of the newborn infant falls during the first 2-3 months of life, considerable iron is recycled. These iron stores are usually sufficient for blood formation in the first 6-9 months of life in term infants. In term infants, anemia is caused solely by inadequate dietary iron usually occurs at 9-24 months of age and is relatively uncommon thereafter.<sup>3,4</sup>

Iron deficiency anemia was defined as the Hb concentration falls 2 standard deviation (SD) below the mean for age as presence of the indexes. Serum iron concentration <40 mcg/dL (younger than 1yr) and <50 mcg/dL (older than 1yr), Plasma ferritin <7ng/L and Total iron binding capacity >430 mcg/dl in children, confirm this status. 1,2,4

Considering the age prevalence of iron deficiency anaemia and febrile convulsion which are the same, the role of iron in the metabolism of neurotransmitters (such as GABA and serotonin) and some enzymes (such as monoaminoxidase and aldehideoxidase), the function of hemoglobin in conveying oxygen to the brain and since fever can exacerbate symptoms that result from anaemia, a relationship between iron deficiency anaemia and febrile convulsions is probable.

#### **METHODS**

The present cross-sectional study was conducted with objective of determining the iron profile in children with simple febrile seizures and children without seizures and also to find out the association between iron levels and simple febrile seizures.

The study period was from January 2016 to March 2018.

Sample size for difference between the means was used to estimate the sample size. A total of 112 children of age 6 months to 6 years were included in the study and further divided into two groups, group 1-56 children with fever and febrile seizures and group 2-56 children with fever but without febrile seizures.

Purposive sampling of the children meeting the inclusion criteria of group 1 (Children with simple febrile seizures and in the age group of 6 months to 6 years) and group 2 (Children without febrile seizures and in the age group of 6 months to 6 years) were included for study and evaluated further for iron profile.

Children with complex febrile seizure, having a history of recent zinc intake within 2 weeks, CNS infection, developmental delay or neurological deficit, CNS malformations and Failure to thrive were excluded from study.

Ethical committee clearance was obtained from the institution ethics and review board (IERB) before starting

the study. Written informed consent from the parents/guardians of the children to participate in the study was taken.

Demographic data, seizure details, nature of febrile illness, family history of epilepsy /febrile seizures, temperature at admission and nutritional status were recorded.

2 ml venous blood was drawn and sent for estimation of complete blood count with peripheral smear.

Those children who were found anaemic with a peripheral smear suggestive of iron deficiency anaemia (Microcytic hypochromic anaemia with anisopoikilocytosis and tear drop cells) an iron profile study will be done. The details were entered in a predesigned Proforma.

#### Statistical analysis

The collected data was analysed using SPSS 16 software. Continuous variables were presented as mean and standard deviation of the mean (SD), while categorical variables are presented as number and percentage.

Chi square test and student's t test was used to know the association between different indicators of iron deficiency anaemia and febrile seizures. p value <0.05 was considered statistically significant

#### **RESULTS**

The study participants were equally distributed in each age group of 1, 2, 3 and 5 years and only 6% were of age 4 years. In case of gender distribution, the males were relatively high in number when compared to females, 68 (60.7%) were males and 48 (39.3%) were females.

Table 1 and 2 shows the age and gender wise distribution of study participants.

Table 1: Age distribution of study participants.

Age in months	Frequency	Percentage
6-12	39	34.8
13-24	23	20.5
25-36	25	22.3
37-48	7	6.2
49-60	18	16.1
Total	112	100.0

**Table 2: Gender distribution of study participants.** 

Gender	Frequency	Percentage
Male	68	60.7
Female	44	39.3
Total	112	100.0

Table 3: Distribution of study participants based on Hb%.

Hb%	Frequency	Percentage
Anemia present	68	60.7
Anemia absent	44	39.3
Total	112	100.0

Table 4 shows distribution of Haematological parameters among group 1 (Children with fever and febrile seizures) and group 2 (Children with fever and without seizures) with significant association between haematological parameters like Hb%, MCH, TIBC and S. ferritin with febrile seizures

Table 4: Distribution of hematological parameters among group 1 and group 2.

Hematological parameters	Group 1 Mean ±SD	Group 2 Mean ±SD	t-value	p-value
Hemoglobin (MG/DL)	10.27±1.2	11.09±1.4	3.21	0.04
Red blood cell	4.39±0.2	$4.64\pm0.6$	1.45	0.14
Hematocrit (HCT)	30.02±4.2	31.58±4.5	1.70	0.09
MCV	68.80±8.1	68.71±4.1	0.60	0.54
RDWA	43.65±4.5	44.38±4.0	0.74	0.05
MCH	24.12±4.1	25.17±2.8	2.25	0.02
MCHC	35.78±4.8	35.66±2.3	0.28	0.57
Serum ferritin	34.73±3.4	62.36±3.7	1.67	0.01
Total iron binding capacity	390.56±5.67	325.6±8.62	4.22	0.01
T. saturation	10.54±1.1	20.7±1.5	5.47	0.01

#### DISCUSSION

In a study conducted by Mehta between 2011 and 2015, involving 70 cases and 70 controls, Cases were children of age group 6 months to 6 years presenting with febrile seizures.<sup>5</sup> Controls were children of same age group presenting with febrile illness without seizures. Cases and controls were compared with respect to blood indices and serum ferritin. They observed that mean plasma ferritin levels were significantly lower in febrile seizures compared to cases and concluded that early detection and timely correction of iron deficiency may be helpful for prevention of febrile seizures in children.

In a study conducted by Kumari et al between 2010 and 2011, involving 154 cases and 154 controls, Cases were children of age group 6 months to 3 years presenting with febrile seizures.<sup>4</sup> Controls were children of same age group presenting with febrile illness without seizures. Cases and controls were compared with respect to blood indices and serum ferritin. The mean serum ferritin was significantly low in febrile seizure cases compared to controls. They concluded that iron deficiency is a possible risk factor for simple febrile seizures in children.

In a study conducted by Srinivasa et al, between 2013 and 2014, involving 108 cases and 100 controls, serum ferritin was significantly low in cases compared to that of controls and was found that patients with febrile seizures were 2 times more likely to have iron deficiency anaemia compared to febrile patients without seizures.<sup>2</sup> They concluded that iron deficiency anaemia as a modifiable risk factor that predisposes to febrile seizures in children.

Sherjil et al conducted a study between 2008 and 2010 involving 310 children between the age 6 months and 6 years. They had 157 cases (children with febrile seizure) and 153 controls (children with febrile illness without seizures). They found that 31.8% cases and 19.6% of controls had iron deficiency anaemia. They concluded that febrile seizures are 1.93 times more likely to have iron deficiency anaemia.

Vasvani et al observed significant low serum ferritin levels in children with first febrile seizures than in controls, which is similar to present study findings.<sup>7</sup>

Kamalammal R et al observed that the Hemoglobin level, MCH, MCHC, Serum Ferritin levels does not show any significant differences between the two groups disapproving the theory that iron deficiency anemia is a trigger for febrile seizures, and only serum iron which is less in case group showed that iron deficiency can have positive association with febrile seizures. <sup>8</sup> In contrary, the present study findings showed that there is statistical significance in association between HB, TIBC, S. ferritin and febrile seizures.

#### **CONCLUSION**

In the present study prevalence of anaemia was 60.7%. The indicators of iron deficiency anaemia like Hb%, MCH, TIBC and S. ferritin were associated with febrile seizures and were statistically significant.

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