



## Low serum ferritin is a risk for febrile convulsion in children: A study in a Dhaka Shishu (Children) Hospital, Dhaka, Bangladesh

AKM Khairul Islam<sup>1</sup>, Quamrun Nahar<sup>2</sup>, Syed Shafi Ahmed<sup>3</sup>, Rizwanul Ahsan Bipul<sup>4</sup>, HSK Alam<sup>5</sup>

<sup>1</sup> RMO, Emergency, MBBS, DCH, Observation and Referral Unit, Dhaka Shishu (Children) Hospital, Dhaka, Bangladesh

<sup>2</sup> RMO, MBBS, MPH, Anower Khan Modern Medical College, Dhaka, Bangladesh

<sup>3</sup> Director & Head of the Department, MBBS, DCH, MD, PHD, Paediatric Gastroenterology, Hepatology & Nutrition, Dhaka Shishu (Children) Hospital, Dhaka, Bangladesh

<sup>4</sup> Resident Physician, MBBS, DCH, MPH, Dhaka Shishu (Children) Hospital, Dhaka, Bangladesh

<sup>5</sup> Associate Professor, Department of Adolescent Paediatrics, MBBS, DCH, MPH, Dhaka Shishu (Children) Hospital, Dhaka, Bangladesh

### Abstract

Febrile seizure (FS) is defined as "an epileptic seizure occurring in childhood after age 1 month, associated with a febrile illness not caused by an infection of the CNS, without previous neonatal seizures or a previous unprovoked seizure, and not meeting criteria for other acute symptomatic seizures. Iron deficiency anaemia and febrile seizures are two common diseases in children worldwide as well as in developing country. A prospective case-control study was carried out in the Department of Paediatrics, Dhaka Shishu (Childer) Hospital. The study was done during the period from January'2015 to September'2015 with 51 children with first simple febrile seizure as cases and other 51 controls. There were no significant differences in terms of ESR, WBC, platelets, RBC, MCHC, and TIBC levels between the cases and the control group. HB, HCT, MCH, mean serum ferritin and serum iron, were significantly low in the febrile convulsion group as compared to control group. Our present study showed the mean age 24.84(±4.86) months in cases and 25.71(±5.81) in controls. Majority (56%) male was in case group and 52% were in control group. No significant differences between the studied groups in terms of age, sex and socio-economic status was done Family history of febrile seizures and epilepsy were significantly high in cases as compared to control with (p=0.001). Mean serum ferritin was significantly low in children with first febrile seizure and also proportion of children with low ferritin was significantly higher in febrile seizure group than in controls. Iron deficiency and convulsions may be seen in lead poisoning but lead levels could not be determined in our subjects. Larger studies are needed to confirm our findings.

**Keywords:** convulsion, ferritin, fever. RBC, MCHC & TIBC

### 1. Introduction

Febrile seizure (FS) is defined as "an epileptic seizure occurring in childhood after age 1 month, associated with a febrile illness not caused by an infection of the CNS, without previous neonatal seizures or a previous unprovoked seizure, and not meeting criteria for other acute symptomatic seizures" [1]. Febrile seizures occur in 2 to 4% of all children with a recurrence rate of 30 to 40% [2]. Age for peak incidence of febrile seizures is 14 to 18 months which overlaps with that of iron deficiency anaemia which is from 6 to 24 months [3, 4]. Iron deficiency anaemia and febrile seizures are two common diseases in children worldwide as well as in developing country [2]. Iron insufficiency is known to cause neurological symptoms like behavioural changes, poor attention span and learning deficits in children. Therefore, it may also be associated with other neurological disturbances like febrile seizures in children [5]. Iron is needed for brain energy metabolism, for metabolism of neurotransmitters and for myelination and in low iron status, aldehyde oxidases and monoamine are also reduced. In addition, the expression of cytochrome C oxidase, a marker of neuronal metabolic activity, is decreased in iron deficiency [6]. Because iron is important

for the function of various enzymes and neurotransmitters in the central nervous system, low serum levels of ferritin may lower the seizure threshold [7, 8]. We compared iron status in children with febrile convulsion and a control group in order to determine the relationship between iron status and febrile convulsion in paediatric patients.

### 2. Patients and Methods

A prospective case-control study was carried out in the Department of Pediatrics, Dhaka Shishu (Childer) Hospital. The study was done during the study period from January'2015 to September'2015. We enrolled 51 children of the age group 6 months to 3 years with a diagnosis of febrile seizure as cases and 51 controls randomly from patients between 6 months and 3 years of age who were admitted with the same diagnosis of infection (respiratory and gastrointestinal) but without seizure. Diagnostic criteria for febrile seizures included seizures associated with fever and the seizures were generalized, short duration (less than 15 minutes), no recurrence of seizures within 24 hours, child is otherwise neurologically healthy and without any neurological abnormality before and after the episode of seizures. Children who were admitted to the Hospital with a

history of fever and convulsions were included in the study. Children presenting with atypical febrile seizures, afebrile seizures, those having any signs of central nervous system infection, those with any chronic neurodevelopment problems, those who were previously diagnosed cases of other haematological problems, bleeding or coagulation disorders, haematological malignancy, those who were on iron supplementation, and very sick children were excluded from the study. The control and case groups were matched based on family history of FS, age, sex, temperature and cause of illness. With admission, venous blood samples were obtained for complete blood count (CBC), erythrocyte sedimentation rate (ESR), and platelets (PLT) count. Serum iron (SI), serum ferritin (SF) & TIBC including RBC, Hb, HCT, MCV, MCH, and MCHC were measured. The ferritin assay was performed using a Stat Fax 2100 ELISA plate reader (Awareness Technology Inc., USA). Serum iron concentration and TIBC were measured by direct spectrophotometry using an RA 1000 auto analyzer (Technicon Instruments Corporation, USA). Data were entered and analyzed using the Statistical Package for Social Science (SPSS) version -19. Nominal data were expressed as frequency and percentage. Numerical data were expressed as means and standard deviations and were compared using student's t-test. Associations were tested using Pearson's correlations, p-value less than 0.05 were considered significant.

**3. Results**

No significant differences between the studied groups in terms of age, sex and socio-economic status was found. Family history of febrile seizures and epilepsy were significantly high in cases as compared to control with (p=0.001). (Table I). There were no significant differences in terms of ESR, WBC, and platelets, RBC, MCHC, and TIBC levels between the cases and the control group. HB,

HCT, MCH, mean serum ferritin and serum iron, were significantly low in the febrile convulsion group as compared to control group (Table II).

**4. Discussion**

Our present study showed the mean age 24.84(±4.86) months in cases and 25.71(±5.81) in controls. Majority (56%) male was in case group and 52% were in control group. No significant difference between the studied groups in terms of age, sex and socio-economic status was done. Family history of febrile seizures and epilepsy were significantly high in cases as compared to control with (p=0.001). Compared to the study of Ahmed [9] also supported our results, they also showed no significant differences between the studied groups in terms of age, sex and socio-economic status. The mean age of onset in Majumdar R *et al.* [10] study is 24 months which is comparable to the other studies. Separate studies done by Vaswani RK *et al.* [11] and Waruiru C *et al.* [12] also found FS peaks at 18 months. Ellenberg *et al.* [13] found the average convulsion age to be 23.3 months. In study of Majumdar R *et al.* [10] boys have consistently emerged with higher frequency of febrile seizures. In this study there were no significant differences in terms of ESR, WBC, platelets, RBC, MCHC, and TIBC levels between the case and the control group. HB, HCT, MCH, mean serum ferritin and serum iron, were significantly low in the febrile convulsion group as compared to control group (Table 2). Similar results found in different studies Ahmed [9] and Majumdar *et al.* [10] analyzed for Iron deficiency as a risk factor for febrile convulsion, by biochemical and hematological investigations. In Majumdar R *et al.* [10] study mean Hb, MCV and MCH was 8.92g%, 67.03 fl, 30.66 pg respectively which was significantly low in cases compared to control. Kumari PL *et al.* [14] and Naveed-ur-Rehman *et al.* [15] had results similar to our study.

**Table 1:** Demographic characteristics of simple febrile convulsion of children (N=51)

Demographic Characteristics	Cases	Control	p value
	Mean ± SD	Mean ± SD	
Age in months	24.84(±4.86)	25.71(±5.81)	0.69
Sex	Male	28(56%)	1.0
	Female	23(46%)	
Socio-economic Status	Lower class	26(52%)	0.48
	Middle class	21(42%)	
	Upper class	03(06%)	
Family history of febrile seizure	17(34%)	07(14%)	0.001
Family history of epilepsy	14(28%)	05(10%)	0.001

**Table 2:** laboratory data between cases and controls (N=51).

Laboratory Parameters	Cases	Control	p value
	Mean ± SD	Mean ± SD	
ESR mm/hr	13.9±2.5	14.8±2.6	0.17
PLT /mm <sup>3</sup>	334.35±47.77	317.33±56.59	0.06
WBC imm <sup>3</sup>	12.6±2.47	12.2±2.32	0.56
RBC mL/ Cu mm	4.07±217.60	4.0±236.54	0.26
HB g/dL	10.23±1.31	11.56±1.78	0.001
HCT %	32.21±1.64	34.17±1.49	0.001
MCV fL	79.21±2.07	79.57±1.25	0.29
MCH pg	25.81±1.21	27.79±1.41	0.001
MCHC g/L	33.10±1.44	33.36±1.23	0.07
Serum Ferritin ng/mL	51.75±16.78	78.42±2.37	0.001
Serum Iron tlg	61.27±1.73	86.77±1.45	0.001
TIBC ug/dL	377.14±5.18	376.15±5.23	0.21

In the case-controls study done by Pisacane *et al.* [16] with 146 cases and 293 control, reported a significantly higher rate of iron deficiency anemia among children with first febrile seizure than control (odd's ratio=3.3, 95% CI of 1.7-6.5). In the study done by Daoud *et al.* [17] mean plasma ferritin level was significantly lower in the cases (29.5 µg/l) than in the controls (53.3 µg/l) (P=0.001). Other measures of iron status were also lower among first febrile seizures patients, but the difference didn't reach statistical significance. Study done by Kumari *et al.* [18] found highly significant association between iron deficiency and simple febrile seizures. In present study mean serum ferritin and serum iron, were significantly low in the febrile convulsion group as compared to control group (Table II). In study of Sit *et al.* [1] showed serum ferritin level significantly lower in cases (24.81±9.04) than control group (47.29±8.33) with p value <0.002. Vaswani *et al.* [19] study also found similar results, they showed the mean serum ferritin level (µg/L) significantly low in Cases (31.9 ± 31.0) as compared to Controls (53.9 ± 56.5) with P = 0.003. Srinivasa S and Sai Praneeth Reddy study [20] also showed low levels of haemoglobin level and serum ferritin level of cases in comparison of controls.

## 5. Conclusion

Mean serum ferritin was significantly low in children with first febrile seizure and also proportion of children with low ferritin was significantly higher in febrile seizure group than in controls. Iron deficiency and convulsions may be seen in lead poisoning but lead levels could not be determined in our subjects. Larger studies are needed to confirm our findings.

## 6. References

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