

A CASE CONTROL STUDY USING RBC INDICES AND MENTZER INDEX FOR PREVALENCE OF IRON DEFICIENCY ANEMIA AMONG CHILDREN WITH FEBRILE SEIZURE

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Abstract

Background: (FS) Febrile Seizure is considered as mutual disease (childhood's seizure) in almost 2 - 5 percent of children. Many studies have shown contradictory results about the link among iron deficiency anemia and febrile seizures. According to WHO iron deficiency anemia is defined as concentration of anemia below halt level (11 g/dl) among children age between 6-59 months. The major purpose to conduct this study is for iron deficiency anemia prevalence among febrile seizure children using Mentzer index and RBC indices. **Material & Methods:** It is a case control study in which a complete blood count of 6-60 months old admitted children having first febrile seizure to RC and VIMS from July 2022 to December 2022 was compared and done with children without FS (febrile seizure). **Results:** The results of this study show the demographic characteristic, laboratory characteristics and iron deficiency anemia among children of both groups (control and study group having febrile seizures). Out of 58 children, in 29 children with febrile seizures level of hemoglobin (11.12 vs 12.18), MCV (72.45 vs 76.50), RBC (4.768 vs 4.83), MCHC (32.05 vs 32.7), and Mentzer index (MCV. RBC) (15.37 vs 15.97). **Conclusion:** According to this study outcomes, anemia is considered as a crucial risk factor in order to develop febrile convulsion. In children having febrile seizure iron status evaluation is stimulated to be executed or performed.

INTRODUCTION

Febrile convulsion is the most frequent form of seizure in children, occurring in 2-5 percent of children without any neurological problems. It is described as a seizure that is linked to a feverish illness and is not caused by any central nervous systems infections or sudden changes in electrolyte levels.^[1] It mostly occurs in children aged among 6-60 months have not experienced seizures without fever before. Febrile convulsion can be categorized into two types: complex and simple. Complex febrile convulsion is elaborated as a seizure that lasts greater than 15 minutes, occurs repeatedly within 24 hours, or is localized to a specific body part. Iron deficiency is commonly occurring micronutrient deficiency that impacts a minimum of 33 percent of the world's population.^[2] Anemia is the most prevalent symptoms of iron deficiency, but it can also affect other parts of the body and systems. Anemia, which is widespread among

infants and children globally, is described as having a level of hemoglobin that is two standard deviations lower than the average for their age group.^[3] The classification of anemia as either microcytic or normocytic is determined by the mean corpuscular volume (MCV), which is a crucial factor in distinguishing between various form of anemia. Iron deficiency-induced microcytic anemia is the most frequent type of anemia found in children. Biochemical iron deficiency can be detected by low levels of serum ferritin and serum iron.^[4] Iron-limited erythropoiesis, on the other hand, can be identified by a decrease in both the reticulocyte hemoglobin content and the mean corpuscular volume without a decrease in hematocrit or hemoglobin. Iron deficiency may cause slow psychomotor function, cognitive dysfunction, thrombosis, cause pica, impair behavior, restless leg syndrome, and breath-holding spells.^[5] Iron deficiency can be categorized based on its severity into three groups: first is lack of iron in the body despite normal production of red blood

cells. Secondly, lack of iron causing limited production of red blood cells but without the development of anemia. Thirdly, lack of iron leading to iron deficiency anemia.^[6] The impact of iron deficiency on the developing brain can result in various consequences, including altered development of energy metabolism impairment, hippocampus neurons, delayed myelin maturation, auditory evoked potentials and slowed visual, and variations in system of synaptic neurotransmitter i.e., serotonin, GABA, Glutamate, Norepinephrine and Dopamine. This mechanism may be accountable for the symptoms associated with deficiency of iron. Conversely, fever has the potential to worsen the adverse impacts of iron deficiency on the brain.^[7] Studies that have investigated the relation among febrile seizures and iron deficiency have produced contradictory outcomes. The majority of previous research has compared the iron levels in febrile children who had seizures to those who did not. Typically, children and infants who have mild anemia do not display noticeable clinical symptoms and signs. Therefore, an initial evaluation should involve a detailed history, including questions about prematurity, chronic illness, family having anemia history, low birth weight, and ethnic background.^[8] The most common initial diagnosis test for anemia is a complete blood count, which can differentiate among macrocytic, microcytic and normocytic anemia based on the mean corpuscular volume. The study aims to relate the levels of iron in children who experienced their first FS with those in a healthy control group.^[9]

MATERIALS AND METHODS

It is a study of case control, by using Z formula sample size and almost 95 percent interval of confidence with 5 percent type of error, and 80 percent power in order to find out any important difference among two groups iron status.^[10] This case study involves a case group based on 6-60 months admitted old children having febrile seizures to Vydehi institute of medical science and research center (VIMS and RC) from July 2022 to December 2022. The control group of this study involves a healthy sex matched and similar aged children who

are mentioned to primary care of health at VIMS and RC. The inclusion criteria of this study is children who are admitted with febrile seizures to experimental group are almost 6 to 60 months old. The children of control group is without febrile seizures and their age and sex is watched.^[11] The criteria for excluding participants are: having taken a combination of iron supplements in the last month, having any ongoing chronic systematic conditions i.e., rheumatologic disorders, cardia, metabolic, renal malignancy, having neurodevelopmental delays, having experienced a previous febrile seizure, or having an acute infection of the central nervous system such as encephalitis or meningitis. Both the experimental and control group had a venous blood sample taken, and laboratory tests were performed to measure the hemoglobin levels, (MCV) mean corpuscular volume, (MCHC) mean corpuscular hemoglobin concentration, (RDW) red cell distribution width and Mentzer index (MCV/RBC) at Vydehi institute of medical science and research center (VIMS and RC).^[12] In children among 6 – 60 months age, anemia is defined as having a hemoglobin level below 10.5 g/dl, while in those among 2 – 6 years old, it is defined as having a hemoglobin level below 11.5 g/dl. The definition of iron deficiency includes a serum ferritin level of less than 12 ng/ml when (CRP) negative C-reactive protein or at a level of more than 1.^[13] If the level of CRP is greater than or equal to 2, then deficiency of iron is definite as a serum ferritin level of lower than 30 ng/ml. alternatively, deficiency of iron can be defined as having serum iron levels below 22 or transferrin saturation levels of less than 16 percent. This principle has 75 percent sensitivity and 76 percent specificity, based on previous studies.^[14]

RESULTS

Twenty-three girls and thirty-five boys with mean age of 33.3 and 33.8 months were evaluated. In this study two groups were evaluated the experimental group having 11 girls and 18 boys and control group having 12 girls and 17 boys. In table 1 there is a demographic-characteristics i.e., sex, age, weight of children. The p-value of demographic characteristics shows that they are non-significant .^[15]

Table No 1: Children demographic characteristics comparison among both groups

Demographic variable	quantity	Febrile seizure (FS)	Healthy control group	p-value
Sex	Girls	11 (37.9%)	12 (41.37 %)	0.53
	Boys	18 (62.1%)	17 (58.62 %)	
Age in months (mean)		33.33	38.8	0.51
Weight in kg		14.66	13.15	0.21

a comparison among children according to the laboratory characteristic of both the groups is shown in table 2 below. These laboratory characteristics involves hemoglobin level, MCV, Hb, MCV, RBC, MCHC, RDW and Mentzer index.

Table No 2: comparison of children lab characteristics among both groups

Group	Febrile seizures	Control group	p-value
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Laboratory findings	Mean	Mean	
Hemoglobin level	11.12	12.18	0.041
MCV	72.45	76.50	0.750
RBC	4.768	4.83	0.002
MCHC	32.05	32.7	0.001
RDW	16.08	14.75	0.854
Mentzer index (MCV. RBC)	15.37	15.97	0.576

[Table 2] indicates that hemoglobin level, RBC and MCHC level are noted less in children with febrile seizures compare to the control group. The P value for these parameters is <0.05, indicates that they statistically significant. Other parameters like MCV, RDW and Mentzer index noted to have P value >0.05, indicating that they are statistically insignificant.

DISCUSSION

The study conducted a comparison among the iron levels of children who faced first FS and those of strong children with the same gender and age. The results displayed that the children with febrile seizures had lower hemoglobin, serum iron, and serum ferritin levels than the healthy children.^[17] Table no 2 shows comparison of lab characteristics i.e., level of hemoglobin, RBC, MCB, MCHC, RDW and MENTZER index among children of both groups. Level of hemoglobin in febrile seizures is 11.12 and in control group is 12.^[18] Mean corpuscular volume (known as an average red blood cell size) in febrile seizures is 72.45 and control group is 76.50. Red blood cells in febrile seizures 4.768 and in control group is 4.83. Zareifar et al conducted a study in Iran in which he found that a higher children's percentage with febrile seizures had iron deficiency, defined as a serum ferritin level below 20ng/dl, compared to those without seizures. Interestingly, in this study, febrile children without seizures had lower hemoglobin levels than those with seizures.^[18] Alternatively, three studies from Iran described that plasma ferritin levels and serum iron were advanced in children with febrile seizures compared to those without seizures. In several studies from Iran, it was observed that iron deficiency anemia was less common in children with febrile seizures compared to those without seizures.^[19] According to the Kobrinsky research conducted in Fargo, children who experienced febrile seizures had a lower occurrence of iron deficiency, but their hemoglobin, MCV levels and hematocrit were higher. Anemia is a matter of global concern for public health, and both the WHO and American academy paediatrics advocate for screening for anemia at the age of one. According to the recommended daily iron intake, infants from birth to six months old require 0.27 mg, and from seven months to one-year-old, this increases to 11 mg. infants aged between six and twelve months are at a higher risk of developing iron deficiency, especially if they are fed with non-fortified milk formula or breast milk.^[20] The iron reserved that full-term infants have are depleted during the first four to six months of life. Breastfed infants who do not get sufficient iron should be given iron drops prescribed by their doctor. The authors proposed

that iron deficiency anemia could possibly safeguard these children against febrile seizures. In a study by Talebian et al. in Kashan, Iran it was observed that the likelihood of febrile seizure occurrence in children with anemia was lower compared to those without anemia.^[21] However, in three other Iranian studies, there was no significant difference in the incidence of iron deficiency anemia among febrile seizures children and without febrile seizure children. The difference in geographic location, age, control group, and dietary habits could be potential reasons for the inconsistencies observed in these studies. In this study there was a higher incidence of iron deficiency anemia observed among patients who had complex febrile seizures, which is consistent with findings from a study conducted in Turkey. Iron deficiency may impact the neurotransmitters in the brain's synapses. It can cause an increase in excitatory neurotransmitters such as monoamines reduction, Glutamate and a reduction in inhibitory neurotransmitter like GABA. Additionally, the lack of oxygen caused by iron deficiency anemia could contribute to the occurrence of seizures due to deficiency of iron.^[22]

CONCLUSION

According to the findings of this research, a higher children's number with febrile seizures agonize from anemia (probably iron deficiency anemia). This case-control study utilized RBC indices and the Mentzer index to investigate the prevalence of iron deficiency anemia among children who experience febrile seizure. Iron level to be estimated in all children with febrile seizures. This study may provide valuable insights into relationship among febrile seizures and iron deficiency anemia in children. Further research is needed to authenticate these answers and find out the appropriate inventions and management strategies for iron deficiency in this population.

Conflict of interest

In this study there is no conflict of interest.

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