DOI: https://doi.org/10.53350/pjmhs020241868

ORIGINAL ARTICLE

Frequency of Iron Deficiency Anemia in Children Presenting with Febrile Fit

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ABSTRACT

Background: The purpose of this study is to estimate the percentage of children with IDA in febrile convulsions attending Bolan Medical Complex Hospital, Quetta. In this cross sectional study, an attempt will be made to identify the correlation between IDA and febrile convulsions in children.

Methods: A cross-sectional study was conducted to determine the prevalence of iron deficiency anemia (IDA) in 150 children aged 6 months to 5 years with febrile seizures at Bolan Medical Complex Hospital Quetta. Data was collected through structured questionnaires, including demographic, clinical, and nutrition history details. Participants were selected based on age and presentation features. Seizure characteristics, dietary recall, and breastfeeding practices were also assessed. Parents provided informed consent before participation. One hundred and fifty children, between the age of 6 months and 5 years were participated in the study. Blood hemoglobin, serum ferritin, serum iron, and total iron-binding capacity were analyzed.

Results: IDA was present in 45% of those children who had febrile seizures at point of this study. Also, IDA was linked to a higher incidence of complicated febrile seizures; 40 percent of IDA patients had had a complicated Febrile seizure compared with non-IDA 15 percent.

Conclusions: The study brings attention to the need of routine checks of iron deficient acutely in pediatric patients with febrile seizures. Improving nutrition might perhaps prevent febrile seizures or even lessen their intensity.

Keywords: Proportion of children, hemoglobin, serum ferritin, serum iron, nutritional deficiencies

INTRODUCTION

Iron deficiency anemia (IDA) is a common nutritional condition that mostly affects children from impoverished nations and has an impact on growth, cognitive development, and general health. Low iron levels cause haemoglobin levels to drop and oxygen delivery to become compromised, which causes IDA[1]. The link between IDA and febrile seizures, which are prevalent in young infants and are characterized by convulsions brought on by fever, is a developing issue[2, 3]. Based on their length and frequency, these seizures are categorized as simple or complex. They usually affect children between the ages of 6 and 60 months. Knowing the connection between IDA and febrile seizures may aid in the early detection and care of children who are at risk[4]. According to estimates from the World Health Organization, IDA is the primary cause of anemia, which affects 500 million to two billion people globally. 33.2% of children in Pakistan suffer from this condition, which is linked to nutritional deficiencies, inadequate micronutrient consumption, and problems getting access to healthcare[5,6]. IDA has a significant effect on brain development because it affects neurotransmitter function and slows neuron myelination in regions of the brain including the hippocampus[7]. These effects may cause behavioral problems, sleep disruptions, and cognitive impairments. Furthermore, IDA alters important brain enzymes, impairing regular neurological processes and perhaps lowering a child's tolerance for seizures[8].

In addition to being essential for hemoglobin formation, iron is also necessary for myelination, neurochemical processes, and brain energy metabolism. Children with IDA often display poor focus, impatience, and learning challenges[9]. Severe IDA instances have been linked to brain disorders including pseudotumor cerebri. The possibility that iron deficiency contributes to febrile seizures is especially significant since iron is necessary for healthy brain development and function and because low levels of iron might change the neurochemical balance and raise the risk of seizures[10].

Several research efforts have been made on the relationship between IDA and febrile seizures with differing levels of outcomes. Prior research revealed that children with febrile seizures have been described as having low blood ferritin, implying that there is less iron is stored. As it is widely understood that the iron deficiency can affect the neurological thresholds with potential of contributing to the febrile seizures in children, there is conflicting data11. This link stresses that increased consciousness regarding early identification and treatment of iron-deficiency anemia in kids might reduce the risk of seizures and actually improve subsequent neurologic development12.

This is due to the fact that iron deficiency anemia in young children requires regular screening and management and this is even complicated by the choa by the choice of preventative measure for children's febrile seizures. There is the need to ensure that public health measures aim at encouraging people to carry high iron diets and supplement taking since people from areas such as Pakistan are likely to suffer from IDA. Parents and other caregivers should be made understand the importance of including foods such as lean meats, beans and fortified cereals into the diets of children. Iron absorption is improved by foods high in vitamin C, thus these should also be promoted. These precautionary measures may lessen the dangers connected with IDA. Iron deficiency has a substantial influence on cognitive function in addition to physical health. Cognitive and behavioral difficulties in children with IDA may be attributed to delayed myelination, decreased neurotransmitter synthesis, and poor brain metabolism[14]. These kids often struggle with memory, focus, and motor development. Research has also shown the crucial function that iron plays in brain development by connecting iron shortage to problems with mood management and learning. Iron obviously plays a major part in brain function, even if the association between IDA and febrile seizures is still unclear, with some research suggesting a link and others not. A low iron level may change brain chemistry and make a person more susceptible to seizures. To precisely define this link and to guide treatment practices, further study is required[15].

This research aims to ascertain the prevalence of IDA in children experiencing febrile seizures. The study investigates a possible connection between IDA and febrile seizures, since both conditions are prevalent in children between the ages of six months and five years. By establishing this link, pediatric health outcomes may be improved by highlighting the significance of early treatment and routine measurements of iron levels. It could help to change health policy and dietary information aimed at increasing kids' iron intake. Recommendable nutritional assessments and comprehensive intervention are critical determinants of good care of children who experience febrile seizures.

METHODOLOGY

The current cross sectional study was conducted to find out the prevalence of IDA in 150 children aged 6 months to 5 years attendants with febrile seizures at Bolan Medical Complex Hospital

Quetta. In the selection of participants consecutive sampling was used. The study only involved children who had features of febrile seizures which are related to age and presentation. Parents or guardians completed a signed informed consent before the children participated. Data was gathered by structured questionnaires covering the following domains; demographic details, clinical details, nutrition history. General information was their age, gender, weight, and their height. Body mass index was obtained using calibrated weighing machines and body height with calibrated height measuring instruments known as stadiometers. BMI was used to determine the nutritional state of subjects. Clinical data covered detailed history of seizures, febrile or afebrile, a list of chronic diseases and family history of seizures.. Seizure characteristics, including type (simple or complex), episode duration, frequency, duration of fever prior to the seizure, and peak temperature, were also documented. Nutritional history was gathered through a 24-hour dietary recall, requiring parents to detail all food and beverage items consumed by their child the previous day. This helped assess the intake of iron-rich foods (e.g., meat, beans, fortified cereals) and evaluate breastfeeding practices, including the duration of exclusive breastfeeding and types of solid foods introduced.

Laboratory Investigations: Blood samples were collected within the first 24 hours following a seizure event. The following laboratory tests were performed: hematological tests and iron status testing. Hematological tests included a complete blood count (CBC) conducted using an automated hematology analyzer to determine mean corpuscular volume (MCV), hematocrit, and other essential parameters. A peripheral blood smear was microscopically examined to identify red blood cell morphology indicative of iron deficiency. Iron status testing assessed serum ferritin, serum iron, transferrin saturation, and total iron-binding capacity (TIBC) to evaluate iron status. Low ferritin levels indicated poor iron storage, while serum iron and TIBC provided insights into iron utilization.

Data Analysis: Statistical analysis was conducted to explore the relationship between IDA and febrile seizures, utilizing the collected demographic, clinical, and laboratory data.

Ethical Considerations: Ethical approval was obtained, and all participant information was kept confidential. The study aimed to contribute to public health knowledge and enhance management strategies for children experiencing febrile seizures.

RESULTS

Descriptive epidemiological study was conducted on 150 kids, 6 months to 5 years age, who presented to Bolan Medical Complex Hospital Quetta, with febrile seizures. The participants were 2. 5 years of age, male (60 %) and Female (40 %). The table 1 presents the demographic characteristics of the study population.

Table 1: Demographic Characteristics Table

Variable	Percentage (%)	Frequency (N=150)
Age (months)		
6-12	26.7%	40
13-24	23.3%	35
25-36	16.7%	25
37-43	13.3%	20
44-50	20%	30
Geder		
Male	56.7%	85
Female	43.3%	65

The table 2 presents the prevalence of iron deficiency anemia (IDA) among children aged 6 to 60 months at Bolan Medical Complex Hospital. Out of 150 participants, 67 children were identified as IDA positive, while 83 were IDA negative. The age distribution reveals that the highest prevalence of IDA was in the 13-24 months age group, with 18 cases, whereas the lowest prevalence was observed in the 49-60 months age group, with 7 cases. Gender analysis indicates that 35 males were IDA positive compared to 32 females. These findings underscore the importance of addressing nutritional deficiencies; particularly iron deficiency, in this vulnerable pediatric population.

Table 2: Prevalence of Iron Deficiency Anemia (IDA) Among the Study Population

Variable	IDA Positive (N = 67)	IDA Negative (N = 83)	Total (N = 150)
Age Group (months)			
6-12	15	15	30
13-24	18	22	40
25-36	17	18	35
37-48	10	15	25
49-60	7	13	20
Gender			
Male	35	50	85
Female	32	33	65

Figure 1 clearly demonstrates the differences in iron status between children with and without IDA. IDA-positive children show significantly lower serum ferritin and iron levels, while their TIBC is higher compared to IDA-negative children, reflecting the typical profile of iron deficiency.

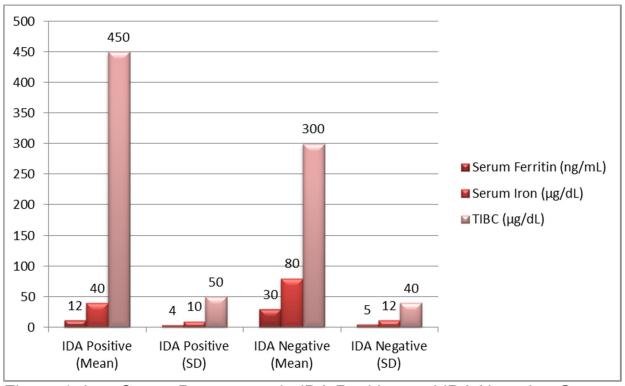

Figure 1: Iron Status Parameters in IDA Positive and IDA Negative Groups

IDA that was observed among the youngsters signed up for the study was 45%. The blood tests showed that 35/60 Kids had raised TIBC and low serum iron 40/60 of the kids had low serum ferritin. Based on this value, the subjects' mean hemoglobin level was at the low end of normal range, which can perhaps be characterized as mild anemia. By far the proportion of complicated seizures by characteristics of seizures were at 30% while simple febrile seizures were found at 70%. Remarkably, while 15% of the children without IDA had complex seizures, 40% of the children with IDA were deemed to have complex seizures. In addition, the mean value of fever of the IDA group was two days prior to the onset of the seizure unlike to the non-IDA group, which had a mean value of 1. 5 days.

Table 3: Seizure Characteristics

Seizure Characteristics	Frequency (N=150)	Percentage (%)
Duration of Seizures (minutes)		
< 5 minutes	100	66.7%
5-10 minutes	30	20%
> 10 minutes	20	13.3%
Recurrence within 24 hours		
Yes	40	26.7%
No	110	73.3%

The percentage of nutrient profiling showed that only a quarter of the young kids often consumed foods rich in iron with the regular food types, prepared in their diets being occasionally lean meats and fortified cereals. In regard to weaning habits, the

following were observed; 60% of the babies were exclusively breast fed with an average of 4 months as shown in figure 2.

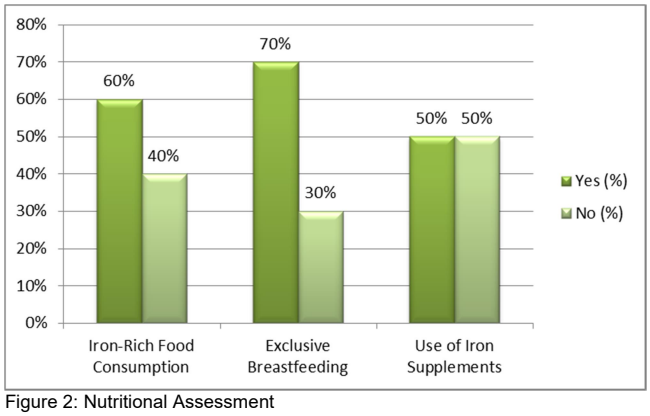

Figure 2: Nutritional Assessment

DISCUSSION

The findings of the current study explain the prevalence of IDA in children with febrile convulsions at Bolan Medical Complex Hospital in Quetta. This study points to a strong need to address nutritional deficiencies in patient populations, particularly children in low-income countries like Pakistan, as 45 percent of the patients were diagnosed with IDA. Given that iron deficiency is one of the most common public health concerns primarily impacting low-income populations, the results indicate an essential association between IDA and brain performance.

Iron plays a critical role in the growth and proper functioning of the brain. It is required to myelinate axons, synthesize neurotransmitters, and support cognitive development. The established link between IDA and complex febrile seizures suggests that children lacking adequate iron may be more neuroexcitable, potentially increasing the incidence of seizures. This is consistent with previous findings indicating that iron deficiency interferes with several neurophysiological processes that may lead to seizures[16]. Regular nutritional assessment is crucial in managing pediatric patients with febrile seizures, especially since children with IDA experienced more complex seizures. The study revealed concerning dietary patterns, with only 25% of the children achieving a healthy iron-enriched diet. Factors such as socioeconomic status, food availability, and parental knowledge about healthy foods contributed to this low iron intake. Nutritional counseling is essential to inform parents about rich sources of iron and the importance of its intake to prevent IDA. Additionally, gaps in newborn feeding practices, particularly inadequate exclusive breastfeeding beyond four months, must be addressed to reduce nutritional deficiencies in young children[17].

It is the intention of this paper to further review the correlation between the shortage of iron and febrile convulsions comprehensively. Although there appear to be a direct relationship between the two variables some researchers have found no direct correlation between them and therefore call for further research on the possible mechanisms between the two18. When the body temperature increases, children with iron deficiency may be more prone to febrile seizures more due to changes in the neurochemical milieu. It cannot be overstated how frequent febrile seizures are, and therefore, having IDA may be a causative factor. These two burdens can be detrimental to the growth and development of the child hence the need to address the neurological and nutritional disorders reconcile themselves with each other at some levels19. The high level of IDA found in this group is supported by other studies which show low level of iron availability in communities including LMICs. This nutritional deficiency has therefore not been eradicated in Pakistan for the simple reason that there are hardly any public policies or inadequate health facilities to address the issue. To lower the prevalence of IDA in children, community, and public health, we should consider approaches that make the amount of available dietary iron higher due to fod fortification and supplementation use. Elimination of these deficiencies may reduce febrile seizures, enhance child development, and enhance children's health status. The observed results underscore the necessity of early diagnostics and treatment for pediatric patients with febrile seizures. Aggressive screening for iron deficiency, along with appropriate management, could mitigate long-term impacts on behavioral and cognitive well-being in vulnerable populations. Healthcare professionals should be equipped to recognize the signs of IDA and adhere to proper screening procedures. In addition to improving outcomes for individual patients, these actions can contribute to broader initiatives aimed at reducing the incidence of iron deficiency anemia[21].

Nonetheless, this research has limitations in providing relevant information regarding the association between IDA and febrile seizures. The cross-sectional design poses challenges in establishing cause-and-effect relationships, and despite a sufficiently large sample, the results may not be representative of all children in Pakistan. Future research should focus on the long-term effects of IDA, the timing of its occurrence in relation to febrile seizures, and the neurological implications that may arise. Additionally, qualitative research exploring parents' beliefs about nutrition and medical care could inform targeted interventions to improve overall dietary practices.

CONCLUSION

The study identified a significant association between IDA and FS in children aged 6-60 months, with a prevalence of 45%. The findings highlight the need to address dietary deficiencies, as inadequate iron intake can impair brain development and increase seizure susceptibility. Pediatric healthcare professionals should prioritize assessing nutritional status in children with seizures, as treating IDA may reduce seizure occurrences and improve outcomes. Additionally, the study revealed poor dietary practices and breastfeeding rates, underscoring the importance of parental education and community awareness campaigns to promote iron-rich diets. Addressing these issues is vital for enhancing children's health and preventing long-term cognitive repercussions. Future research should explore the long-term effects of iron deficiency and effective intervention strategies.

REFERENCES

1. Mantadakis E, Chatzimichael E, Zikidou P. Iron deficiency anemia in children residing in high and low-income countries: risk factors, prevention, diagnosis and therapy. Mediterranean Journal of Hematology and Infectious Diseases. 2020; 12(1). https://dx.doi.org/10.4084%2FMJHID.2020.041.
2. Cococcioni L, Pensabene L, El-Khouly S, Chadokufa S, McCartney S, Saliakellis E, Kiparissi F, Borrelli O. Ferric carboxymaltose treatment for iron deficiency anemia in children with inflammatory bowel disease: Efficacy and risk of hypophosphatemia. Digestive and Liver Disease. 2021 Jul 1;53(7):830-4.
3. Geerse DA, Bindels AJ, Kuiper MA, Roos AN, Spronk PE, Schultz MJ. Treatment of hypophosphatemia in the intensive care unit: a review. Critical Care. 2010 Aug;14:1-8.
4. Andriastuti M, Ilmana G, Nawangwulan SA, Kosasih KA. Prevalence of anemia and iron profile among children and adolescent with low socio-economic status. International Journal of Pediatrics and Adolescent Medicine. 2020 Jun 1; 7(2):88-92.
5. Shang J, Yamashita T, Fukui Y, Song D, Li X, Zhai Y. Prevalence, incidence, and recurrence of febrile seizures in Korean children based on national registry data. Journal of clinical neurology. 2018;14(1):43-7.
6. Brooks M. Intranasal Midazolam Works for Seizure Emergencies in Kids. Medscape Medical News 2013. Available at http://www.medscape.com/viewarticle/813827. Accessed
7. Awais M, Razzaq A, Ateeq S, Ullah H. Association of iron deficiency anaemia with febrile fits. Journal of Postgraduate Medical Institute. 2022 Aug 19;36(3):162-5.

8. Jang HN, Yoon HS, Lee EH. Prospective case control study of iron deficiency and the risk of febrile seizures in children in South Korea. BMC pediatrics. 2019 Dec;19:1-8.
9. Karimi P, Sayehmiri K, Azami M, Tardeh Z. The association between iron deficiency anemia and febrile seizure. International journal of adolescent medicine and health. 2022 Feb 28;34(1):20190083.
10. Khanna A, Kumar A, Hota D, Sharma A, Swami M. Relationship between iron deficiency anemia and febrile seizures: A case–control study. Medical Journal of Babylon. 2020 Apr 1;17(2):144-7.
11. Sulviani R, Kamarullah W, Dermawan S, Susanto H. Anemia and poor iron indices are associated with susceptibility to febrile seizures in children: A systematic review and meta-analysis. Journal of Child Neurology. 2023 Mar;38(3-4):186-97.
12. Heydarian F, Nakhaei AA, Majd HM, Bakhtiari E. Zinc deficiency and febrile seizure: a systematic review and meta-analysis. The Turkish journal of pediatrics. 2020 Jun 25;62(3):347-58.
13. Surani MK, Yousuf M, Saleem K, Khan S, Ahmad M, Altaf MS. Iron deficiency anemia among children with febrile seizures. The Professional Medical Journal. 2020 Sep 10;27(09):1922-6.
14. Addil F, Rehman A, Najeeb S, Imtiaz H, Khan S. Iron deficiency anemia in children with febrile seizures. Systematic Reviews in Pharmacy. 2021;12(11):3463-5.
15. Ferdous J, Choudhury Z, Debnath B, Chowdhury MJ, Hossain MM, Hasan SH. Low Serum Ferritin Level: A Risk Factor of Simple Febrile Seizures–A Hospital-Based Case-Control Study. Journal of Bangladesh College of Physicians and Surgeons. 2024 Apr 30;42(2):139-43.
16. Neyazuddin M, Nistane R. Iron deficiency as risk factor for febrile convulsion and the association of iron deficiency anemia and febrile convulsion. Asian Journal of Medical Sciences. 2022 Nov 1;13(11):140-5.
17. Bhat JA, Ara R, Sheikh SA, Bhat SU. Association of iron deficiency anemia with simple febrile seizures: a hospital-based observational case-control study. Menoufia Medical Journal. 2020;33(3):882-5.
18. Awad KH, El IA. Evaluation of serum iron and zinc levels in children with febrile seizures. Al-Azhar J Pediatr. 2021;24(4):2464-74.
19. Khosravi SH, Sadati SM, Sherafat VA, Bazargani ZA. Evaluation of diagnostic value of blood indices associated with microcytic anemia in febrile seizures in children. Pakistan Journal of Medical and Health Sciences. 2020;14(3):1753-4.
20. Batool S, Qamar N, Islam A, Jamal S. Incidence of iron deficiency anemia among the children with febrile seizures. The Professional Medical Journal. 2022;29(01):121-5.
21. Saleem MA, Siddique AA. Iron deficiency anemia as a risk factor for the first episode of febrile seizure. Pediatric Rev Int J Pediatr Res. 2020;7:93-6.

This article may be cited as: Ashraf F, Babar H, Ahmed S, Shahwani NK, Rabnawaz K, Anis M, Kakar SU: Frequency of Iron Deficiency Anemia in Children Presenting with Febrile Fit. Pak J Med Health Sci, 2024;18(6):33-36.