ORIGINAL RESEARCH

Assessment of iron deficiency anaemia among school going children

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ABSTRACT
Background: Anemia is characterized by hemoglobin levels that fall below two standard deviations from the mean, taking into account the patient's age and gender. Hence; the present study was conducted for assessing iron deficiency anaemia among school going children. **Materials & methods:** A total of 500 school going children within the age range of 8 to 15 years were enrolled. Complete demographic and clinical details of all the patients was obtained. A Performa was made and detailed information in relation to medical history of all the patients was recorded. All the children were recalled in the morning and blood samples were obtained. The measurement of hemoglobin levels was conducted through a skin puncture blood draw, followed by analysis using a high-precision portable photometer manufactured by HemoCue AB in Angelholm, Sweden (Blood Hemoglobin Photometer). According to the World Health Organization's guidelines, anemia was classified as a hemoglobin concentration below 11 g/dL. **Results:** A total of 500 children were evaluated. Mean age of the children was 11.3 years. 59.2 percent of the children were boys while the remaining were girls. Incidence of iron deficiency anemia was found to be 42.4 percent. Significantly higher incidence of iron deficiency anemia was seen among females. **Conclusion:** Regular monitoring and management of iron deficiency and iron deficiency anemia are essential, particularly in children at high risk, to mitigate potential complications.
Key words: Iron deficiency anemia, Children

INTRODUCTION

Anemia is characterized by hemoglobin levels that fall below two standard deviations from the mean, taking into account the patient's age and gender. Iron plays a crucial role as a fundamental element of the hemoglobin structure. Globally, the predominant cause of anemia is iron deficiency, which leads to the presence of microcytic and hypochromic red blood cells observed in peripheral blood smears. The etiology of iron deficiency can differ significantly based on factors such as age, gender, and socioeconomic background. Patients typically present with vague symptoms, including fatigue and shortness of breath during physical activity. Management involves addressing the root cause of the deficiency alongside iron supplementation. While oral iron is the most common form of supplementation, some cases may necessitate intravenous administration. Research indicates that individuals with iron-deficient anemia tend to experience prolonged hospital stays and a greater incidence of adverse health events.[1-3]While a hemoglobin value below 11 g/dL in children 6-59 months of age is considered as anemia, 11.5 g/dL in children 5-11 years of age, 12 g/dL in children 12-14 years of age and for women above 15 years of age, and 13 g/dL in men above 15 years of age can be accepted as lower limits for anemia.[4-6] Hence; the present study was conducted for assessing iron deficiency anaemia among school going children.

MATERIALS & METHODS

The present study was conducted for assessing iron deficiency anaemia among school going children. A total of 500 school going children within the age range of 8 to 15 years were enrolled. Complete demographic and clinical details of all the patients was obtained. A Performa was made and detailed information in relation to medical history of all the patients was recorded. All the children were recalled in the morning and blood samples were obtained. The measurement of hemoglobin levels was conducted through a skin puncture blood draw, followed by analysis using a high-precision portable photometer manufactured by HemoCue AB in Angelholm, Sweden (Blood Hemoglobin Photometer). According to the World Health Organization's guidelines, anemia was classified as a hemoglobin concentration below 11 g/dL. All data were systematically recorded in a

Microsoft Excel spreadsheet and analyzed using SPSS software.

RESULTS

A total of 500 children were evaluated. Mean age of the children was 11.3 years. 59.2 percent of the children were boys while the remaining were girls. Incidence of iron deficiency anemia was found to be 42.4 percent. Significantly higher incidence of iron deficiency anemia was seen among females.

Table 1: Baseline variables

Variable	Number	Percentage
Mean age (years)	11.3 years	
Boys	296	59.2
Girls	204	40.8

Table 2: Occurrence of iron deficiency anemia

Iron deficiency anemia	Number	Percentage
Present	212	42.4
Absent	288	57.6
Total	500	100

Table 3: Correlation of iron deficiency anemia with age and gender

Iron deficiency anemia	r-value	p-value
With age	0.338	0.712
With gender	-2.128	0.000 (Significant)

DISCUSSION

The World Health Organization (WHO) has identified iron deficiency anemia (IDA) as the most prevalent nutritional deficiency globally, affecting approximately 30% of the population. While IDA is particularly common among children and women, adult men are also at risk, influenced by their socioeconomic conditions and overall health. The primary contributors to IDA include gastrointestinal (GI) bleeding and menstruation in women, although insufficient dietary iron intake and impaired absorption also play significant roles. Iron is essential for numerous cellular functions, encompassing enzymatic reactions, DNA synthesis, oxygen transport, and mitochondrial energy production. Consequently, the manifestations of IDA can be diverse. Symptoms such as shortness of breath, fatigue, palpitations, tachycardia, and angina may arise due to diminished blood oxygen levels. This hypoxemia can trigger a compensatory reduction in intestinal blood flow, resulting in motility disorders, malabsorption, nausea, weight loss, and abdominal discomfort. Additionally, central hypoxia may lead to headaches, vertigo, and lethargy, as well as cognitive deficits; several studies have indicated that cognitive functions improve once anemia is resolved.[7-10] Hence; the present study was conducted for assessing iron deficiency anaemia among school going children.

A total of 500 children were evaluated. Mean age of the children was 11.3 years. 59.2 percent of the children were boys while the remaining were girls. Incidence of iron deficiency anemia was found to be 42.4 percent. Significantly higher incidence of iron deficiency anemia was seen among females. Gedfie S et al. conducted a study to assess the global prevalence and contributing factors of iron deficiency and iron deficiency anemia in children under the age of five. The I² test statistics were employed to evaluate the degree of heterogeneity among the studies. To identify potential publication bias, funnel plot analysis and the Egger weighted regression test were utilized. The findings revealed a global pooled prevalence of 16.42% for iron deficiency anemia and 17.95% for iron deficiency. Factors associated with iron deficiency anemia included being under two years of age and residing in larger family units. Additionally, children born to anemic mothers, those with low birth weight, and those who do not consume iron-fortified milk were identified as significant risk factors for iron deficiency in this age group. The prevalence rates of both iron deficiency anemia and iron deficiency were notably high worldwide, with particularly elevated rates observed in Asia and Africa.[11]

The clinical symptoms associated with iron deficiency are primarily linked to the reduction of iron reserves in the body. Iron plays a crucial role in various cellular functions, including energy metabolism, gene regulation, cellular growth and differentiation, oxygen binding and transport, oxygen utilization and storage in muscles, enzyme activity, and the synthesis of proteins and neurotransmitters. Consequently, iron deficiency represents a systemic disorder that extends beyond a mere hematological issue characterized by anemia. In children, the negative health implications of iron deficiency encompass growth retardation, compromised immune function, hindered behavioral, cognitive, and psychomotor development, as well as diminished work capacity. Iron is essential for the processes of cell growth and differentiation. The enzyme ribonucleotide reductase, which contains iron, is vital for initiating DNA synthesis, thereby influencing the rate of cellular replication. Therefore, a deficiency in iron can impede cellular proliferation. In a study conducted by Soliman et al., the linear growth of 40 children suffering from iron deficiency, with an average age of 17.2±12.4 months, was assessed before and after iron supplementation. The findings indicated that children with iron deficiency were significantly shorter and exhibited reduced growth compared to their counterparts. Furthermore, it was observed that following treatment, the growth metrics of these children showed significant improvement.[12-15] Nazari M et al. conducted a study to assess the prevalence of iron deficiency anemia among Iranian children aged under six years. They gathered Persian and English publications from the years 2001 to 2018. The literature search was

performed across various national and international databases, including SID, MagIran, PubMed, Scopus, and Web of Science, utilizing a range of keywords and their combinations: Iron, Iron deficiency, Iron deficiency anemia, Ferritin, Child, Children, and Iran. The analysis of six selected studies, encompassing a total sample size of 1,700 participants, revealed that the prevalence of iron deficiency and iron deficiency anemia in this demographic was 27.7% and 18.2%, respectively. Furthermore, the findings indicated that the prevalence of iron deficiency anemia was more pronounced in boys compared to girls. Approximately 20% of Iranian children under six years of age are affected by iron deficiency anemia.[12]

CONCLUSION

Regular monitoring and management of iron deficiency and iron deficiency anemia are essential, particularly in children at high risk, to mitigate potential complications.

REFERENCES

1. Wawer AA, Jennings A, Fairweather-Tait SJ. Iron status in the elderly: A review of recent evidence. Mech Ageing Dev. 2018 Oct;175:55-73.
2. Long B, Koyfman A. Emergency Medicine Evaluation and Management of Anemia. Emerg Med Clin North Am. 2018 Aug;36(3):609-630.
3. Govindappagari S, Burwick RM. Treatment of Iron Deficiency Anemia in Pregnancy with Intravenous versus Oral Iron: Systematic Review and Meta-Analysis. Am J Perinatol. 2019 Mar;36(4):366-376.
4. Powers JM. Nutritional anemias. In: Lanzkowsky P, Lipton MJ, Fish DJ, eds. Lanzkowsky Manuel of Pediatric Hematology and Oncology. 7th ed. London: Elsevier; 2022:61 80.
5. Dallman PR. . Blood and blood-forming tissue. In: Rudolph A. (Ed), Pediatrics, 1997. 16th ed. Appleton-Cernuary-Croles, Norwalk, CT.
6. Haemoglobin Concentrations for the Diagnosis of Anaemia and Assessment of Severity. Vitamin and Mineral Nutrition Information System. Geneva: World Health Organization. Available at: https://apps.who.int/iris/bitstream/handle/10665/85839/WHO_NMH_NHD_MNM_11.1_eng.pdf. Accessed February 27, 2023; 2011.
7. Shokrgozar N, Golafshan HA. Molecular perspective of iron uptake, related diseases, and treatments. Blood Res 2019;54:10–16.
8. Lopez A, Cacoub P, Macdougall IC, et al. Iron deficiency anaemia. Lancet 2016;387:907–16.
9. Crielaard BJ, Lammers T, Rivella S. Targeting iron metabolism in drug discovery and delivery. Nat Rev Drug Discov 2017;16:400–23.
10. Cappellini MD, Comin-Colet J, de Francisco A, et al. Iron deficiency across chronic inflammatory conditions: international expert opinion on definition, diagnosis, and management. Am J Hematol 2017;92:1068–78
11. Gedfie S, Getawa S, Melku M. Prevalence and Associated Factors of Iron Deficiency and Iron Deficiency Anemia Among Under-5 Children: A Systematic Review and Meta-Analysis. Glob Pediatr Health. 2022 Jul 6;9:2333794X221110860.
12. Nazari M, Mohammadnejad E, Dalvand S, GhaneiGheshlagh R. Prevalence of iron deficiency anemia in Iranian children under 6 years of age: a systematic review and meta-analysis. J Blood Med. 2019 Apr 29;10:111-117.
13. Osazuwa F, Ayo OM, Imade P. A significant association between intestinal helminth infection and anaemia burden in children in rural communities of Edo state, Nigeria. N Am J Med Sci 2011;3:30-4.
14. Ekwochi U, Odetunde O, Maduka I, et al. Iron deficiency among non-anemic under-five children in enugu, South-East, Nigeria. Ann Med Health Sci Res 2013;3:402-6.
15. Soliman AT, Al Dabbagh MM, Habboub AH, et al. Linear Growth in Children with Iron Deficiency Anemia Before and After Treatment. J Trop Pediatr 2009;55:324-7.
16. Nainani P, Singh HP, Paliwal A, Nagpal N. A rare casereport of clear cell variant of oral squamous cellcarcinoma. J Clin Diagn Res. 2014 Dec;8(12):QD07-9.doi: 10.7860/JCDR/2014/11536.5339.
17. Singh HP, Yadav M, Nayar A, Verma C, Aggarwal P,Bains SK. Ameloblastomatous calcifying ghost cellodontogenic cyst - a rare variant of a rare entity. AnnStomatol (Roma). 2013 Mar 20;4(1):156-60. doi:10.11138/ads.0156.
18. Singh HP, Kumar P, Goel R, Kumar A. Sex hormones inhead and neck cancer: Current knowledge andperspectives. Clin Cancer Investig J. 2012;1(1):2-5. https://doi.org/10.4103/2278-0513.95011.
19. Sharma A, Singh HP, Gupta AA, Garg P, Moon NJ,Chavan R. Granulocytic sarcoma in non-leukaemic childinvolving maxillary sinus with long term follow up: Arare case report. Ann Maxillofac Surg 2014;4:90-5.
20. Puri N, Rathore A, Dharmdeep G, Vairagare S, PrasadBR, Priyadarshini R, et al. A clinical study oncomparative evaluation of the effectiveness ofcarbamazepine and combination of carbamazepine withbaclofen or capsaicin in the management of TrigeminalNeuralgia. Niger J Surg 2018;24:95-9.