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STUDY OF IRON DEFICIENCY ANEMIA AND TREATMENT OUTCOME OF ORAL IRON THERAPY IN IRON DEFICIENCY ANEMIA IN CHILDREN ATTENDING TERTIARY CARE TEACHING HOSPITAL IN LUCKNOW

Paediatrics

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ABSTRACT

Background: Iron deficiency anemia (IDA) remains a notable public health concern globally and in India. Contributing factors include inadequate iron intake, poor iron absorption, increased iron demand, and elevated iron loss. In children, iron deficiency anemia (IDA) is characterized by low iron and serum ferritin levels, leading to an inability to sustain physiological functions. **Aim:** The aim involves assessing the prevalence of IDA, analyzing presenting signs and symptoms, and studying the effect of oral iron therapy. **Method:** The study, conducted at the Paediatrics Department at Integral Institute of Medical Science and Research, encompasses children aged 1 to 14 years. The sample size was calculated to be 150, with specific inclusion and exclusion criteria. The study involved various assessments including physical and systemic examinations, hematological examinations, and oral iron treatment. **Result:** The prevalence of anemia in adolescents was found to be 42%. The sole identified risk factors for anemia were the mothers' educational level and malnutrition resulting from unsupervised diets. Mean rise of haemoglobin in children after supplementation was observed on follow up. **Conclusion:** IDA is treatable and preventable, emphasizing the decline in cases due to national programs. The oral iron treatment is preferred primarily due to its cost-effectiveness and minimal side effects.

KEYWORDS

Iron deficiency anemia, Adolescents, Oral iron treatment

INTRODUCTION:

Globally, iron deficiency (ID) is the most prevalent micronutrient deficiency, particularly affecting children[1-2]. The Comprehensive National Nutrition Survey (CNNS) conducted in 2016-2018 revealed significant anemia rates: 41% in preschoolers (1-4 years), 24% in school-age children (5-9 years), and 28% in adolescents (10-19 years) in India[3]. Nearly half of the 273 million cases of anemia among children aged 6–59 months in 2011 were estimated to be due to iron deficiency[2,4].Iron deficiency anemia remains a notable public health concern globally and in India. Contributing factors include inadequate iron intake, poor iron absorption, increased iron demand, and elevated iron loss. In children, iron deficiency anemia (IDA) is characterized by low iron and serum ferritin levels, leading to an inability to sustain physiological functions. Additionally, ID is a key risk factor for cognitive impairment, impaired immune function, and reduced physical activity capacity[5].

The World Health Organization (WHO) recommends daily oral iron supplementation for all children in regions with an anemia prevalence of ≥40%. In malaria-endemic areas, iron supplementation is advised along with measures to prevent, diagnose, and treat malaria[6]. The 2016 WHO guidelines emphasize the need for additional evidence regarding the optimal schedule, duration, and dose of iron supplementation, as well as the effectiveness of iron supplementation in the presence of co-supplemented micronutrients[7].

Therefore, our study aims to investigate iron deficiency anemia and the treatment outcomes of oral iron therapy in children attending the pediatric department of a tertiary care teaching hospital in Lucknow.

MATERIALS AND METHODS:

150 children in the age group of 1 to 14 years with Hb levels less than the cut-off values for the age, as per NFHS-5 guidelines were included in study. The history and examination was documented on a pre-designed proforma. A social demographic profile including parents' education, family structure and diet consumed (vegetarian, non-vegetarian) was noted. A detailed general physical examination was done to look for pallor, icterus, edema, lymphadenopathy, and anthropometric measurements (weight, height) were made. Oral iron supplementation was given when needed and hemoglobin levels and reticulocyte count were checked at 1month and later at 3 months after starting iron supplementation.

Statistical Analysis:

To analyze the data, appropriate statistical tests were applied. A two-sided P value <.05 was considered statistically significant. Baseline characteristics were compared between the two groups with x2 and Fisher exact tests for categorical variables. All the statistical analysis had been done by using statistical software SPSS (version 16.0). Other data are displayed by various tables and charts by using Microsoft excel.

RESULT:

The study included 150 children, of whom 63 had IDA and 60 completed the 3-month study period. The prevalence of IDA was 42% in this study conducted at Integral Institute of Medical Science and Research, Lucknow. Mean age was 10±2.4 years, with 28.33% aged 1-5 years, 26.67% aged 5-10 years, and 45% over 10 years. Out of 60 IDA children, 61.66% were male, 38.34% female and 56.66% were from rural area while 43.34% were from urban area. 58.33% of mother's had no or only primary education, 28.33% had secondary and 13.33% had higher education as shown in table1.

Table1: Showing Demographic Profile:

Metric	Value
IDA Patients Completing Study	60
Mean Age	10 ± 2.4 years
Age Distribution	
1-5 years	28.33%
5-10 years	26.67%
>10 years	45%
Gender Distribution	
Male	61.66%
Female	38.34%
Residence	
Rural	56.66%
Urban	43.34%
Maternal Education	
No/Primary	58.33%
Secondary	28.33%
Higher	13.33%

Common histories included worm infestation (36.67%), past infections (25%), pica (20%) and pagophagia (13.33%). Most common symptoms were lethargy (70%), irritability (65%), easy fatigability (63.33%) and poor school performance (46.67%).

Pallor was seen in 75%, leuconychia 40%, koilonychia 28.33%, generalized lymphadenopathy 21.67%.

As shown in table2, mean Hb was 9.5 ±1.54 g/dL, PCV 32.95±3.62%, MCV 76.04±5.08 fL, MCH 25.65±1.49 pg, MCHC 31.66±1.02 g/dL. 31.67% had mild anemia, 51.67% moderate, 16.66% severe.

Table2: Showing Hematological Parameters

Hematological Parameters	Observed values
Mean Hb	9.5 ± 1.54 g/dL
Mean PCV	32.95 ± 3.62%
Mean MCV	76.04 ± 5.08 fL
Mean MCH	25.65 ± 1.49 pg
Mean MCHC	31.66 ± 1.02 g/dL

Mean serum iron 27.86 ± 0.93 µg/dL, TIBC 611.01± 67.04 µg/dL, ferritin 10.75 ±0.63 µg/L, transferrin saturation 17.6 ± 0.86% as shown in table3.

Table3:showing Iron Profile

Iron Profile	
Mean Serum Iron	27.86 ± 0.93 µg/dL
Mean TIBC	611.01 ± 67.04 µg/dL
Mean Ferritin	10.75 ± 0.63 µg/L
Mean Transferrin Saturation	17.6 ± 0.86%

Hb increased from 9.5 ± 1.1 g/dL at baseline to 9.81 ± 1.365 g/dL after 1 month and 10.10 ± 1.368 g/dL after 3 months of oral iron therapy. Reticulocyte count increased from 0.5% to 0.92% after 3 months, but not statistically significant, shown in fig1.

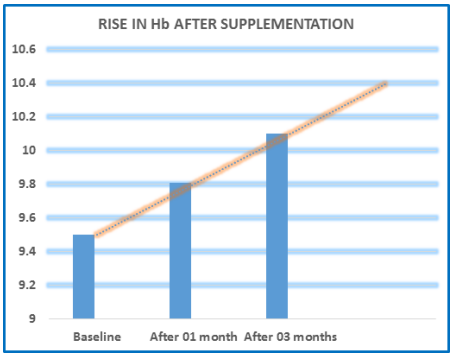

Fig1: Showing mean rise of haemoglobin in children after supplementation

DISCUSSION:

Iron deficiency anemia is a significant health concern impacting over 3.5 billion individuals in developing nations, leading to diminished vitality in both young and elderly populations and adversely affecting the cognitive development of children. Anemia often manifests as a concealed deficiency with few evident symptoms[8]. The present study found a prevalence of iron deficiency anemia in children to be 42%. Earlier studies in India, conducted before 1985, indicated an average prevalence rate of 68% among pre-school children[9-11]. Varied prevalence rates from 48% to 95% were reported across different studies, categorizing all Indian states as having a high magnitude of anemia.

On the demographic front, the study revealed that 55% of children with iron deficiency anemia (IDA) belonged to the younger age group of 1-10 years, aligning with observations from a study by Rayn et al., where 75% of children with IDA were in the 1-2 years age bracket. However, there was no statistically significant difference in sexual distribution in the current study. A majority of cases were from rural areas, and their mothers had limited education. The prevalence of anemia in this group could be attributed to inadequate supervision of the child's diet due to the mothers' lower education levels. In contrast, Chellan et al.'s study observed a higher prevalence of anemia in higher socioeconomic strata with well-educated mothers[12].

The study identified worm infestations as a significant contributor to IDA, accounting for up to 36.67% of cases, while pica was observed in 20.0% of children with iron deficiency anemia. Subjective symptoms such as lethargy, easy fatigability, and irritability were observed in 70%, 63.33%, and 65% of children respectively, whereas objective symptoms like breathlessness, palpitations and chest pain were noted in only 10% and 1.66% each respectively. The lower percentage of objective symptoms in the study population is attributed to the lesser severity of anemia, as evidenced by the mean hemoglobin of 8.8 g/dL in the study population. Previous studies, such as Maheshwari et al., recorded fatigue in 54% and weakness in 38% of cases[13]. Additionally, Lozoff et al.[14] demonstrated that children with iron deficiency experienced more fatigue, engaged in less play, and exhibited greater hesitancy compared to completely healthy children.

In the studied population, low MCV and MCH values were observed, indicative of iron deficiency. Surprisingly, nearly two-thirds of the children exhibited normal S. ferritin levels, and no significant association between iron deficiency and S. ferritin in the anemic study population was established. This finding aligns with Duque et al.'s[15] observation, where over 50% of children aged 1-2 years showed no correlation between iron deficiency and serum ferritin levels.

Reduced MCV and MCH in the complete blood count suggest that erythrocytes appear pale and smaller when hemoglobin levels are diminished. Consistent with Maheshwari et al.'s[13] study indicated low ferritin levels in only 35% of cases. Serum ferritin is considered the most reliable indicator of iron stores in the body and is the first biochemical variable to change in iron deficiency anemia. However, it is essential to note that ferritin, as an acute phase reactant, may also rise during infections and inflammation.

All cases diagnosed with iron deficiency anemia (IDA) received therapeutic doses of iron supplements. Hemoglobin and corrected reticulocyte count were assessed at 1 month, followed by Hb levels alone at 3 months post-initiation of the tablet/syrup. Despite regular consumption of tablets/syrups and good adherence, three children failed to achieve the target Hb level of 11g%, citing side effects such as vomiting, stomachache, and constipation. Additionally, improper administration on an empty stomach and non-compliance with initial instructions contributed to the inability to reach the target Hb level. The study highlights a significant compliance setback, emphasizing the need for increased education for guardians especially mother on the importance of consistent medication adherence to mitigate anemia's adverse effects and minimize iron treatment side effects.

Papagallo S suggested that successful iron supplementation involves combining it with increased dietary caloric intake and modifying dietary habits[16]. A randomized control trial by Sachdev in Reva District, Madhya Pradesh, concluded that the gastrointestinal side effects influenced the outcome of directly observed iron therapy[17]. Consistent with these findings, two out of three cases that did not show improvement in this study reported complaints of vomiting, stomachache, or constipation after taking the tablets.

The potential impact of intercurrent infections on iron absorption or utilization has been observed in this study. Factors such as a history of prior hospitalization, loose stools, or acute respiratory infections (ARI) played a significant role in determining outcomes. Notably, 39 out of 57 controls who showed improvement had no history of such issues, whereas 1 out of 3 cases experiencing these factors did not show improvement. This implies that frequent infections might contribute to non-improvement despite regular iron intake.

In the present investigation, a rise in corrected reticulocyte count and hemoglobin was noted after one month of follow-up. However, the increase in corrected reticulocyte count was lower than anticipated, ranging from 0.8% to 1%. The mean increase in hemoglobin level over three months was only 1.6 g%, whereas an expected rise of 1–2 g% per month was assumed. This discrepancy was attributed to factors such as issues with compliance, gastrointestinal intolerance, and the presence of frequent intercurrent infections.

Studies conducted by Maheshwari et al.[13] and Huang et al.[18] have shown that only 78.9% of children improved with iron treatment. These findings suggest that supplementing only the deficient nutrient may not lead to 100% improvement due to various confounding factors. Therefore, it is important to consider and address these confounders when evaluating the effectiveness of iron supplementation in improving outcomes.

CONCLUSION:

Furthermore, the document discusses the significance of iron deficiency anemia, emphasizing its impact on the global population. It highlights the prevalence of anemia in children, the associated risk factors, and the importance of comprehensive understanding for effective intervention. The research concludes that iron deficiency anemia is treatable and preventable, emphasizing the decline in cases due to national programs and international support. However, the document notes a gap between aspirations to control anemia and the implementation of effective anemia control programs, stressing the

need for proactive measures and commitment.

REFERENCES:

1. Kyu HH, Pinho C, Wagner JA, Brown JC, Bertozzi-Villa A, et al: Global and national burden of diseases and injuries among children and adolescents between 1990 and 2013: findings from the Global Burden of Disease 2013 Study. JAMA Pediatr 2016;170:267-287.
2. Kassebaum NJ, Jasrasaria R, Naghavi M, Wulf SK, Johns N, Lozano R, et al: A systematic analysis of global anemia burden from 1990 to 2010. Blood 2014;123:615-624.
3. International Institute for Population Sciences (IIPS) and ICF. 2021. National Family Health Survey (NFHS-5),2019-21:India:Volume1.Mumbai,IIPS.
4. Stevens GA, Finucane MM, De-Regil LM, et al.. Global, regional, and national trends in haemoglobin concentration and prevalence of total and severe anaemia in children and pregnant and non-pregnant women for 1995-2011: a systematic analysis of population-representative data. Lancet Glob Health 2013;1:e16–25.
5. Mehta, Unnati & Dey, Sagnik & Chowdhury, Sourangsu & Ghosh, Santu & Hart, Jaime & Kurpad, Anura. The Association Between Ambient PM2.5 Exposure and Anemia Outcomes Among Children Under Five Years of Age in India. Environmental Epidemiology.2021; 5. e125. 10.1097.
6. McClung J. P. (2016). Iron Supplementation in Children with Malaria: Timing the Treatment. The Journal of nutrition, 146(9), 1623–1624.
7. Guideline: Daily Iron Supplementation in Infants and Children. Geneva: World Health Organization; 2016. Available from:https:// www.ncbi.nlm.nih.gov /books /NBK362032/
8. IDPAS. (Iron Deficiency project Advisory Service) - CD Rom. International Nutrition Foundation. 2001.
9. Community studies using common salt fortified with Iron. Annual report. Hyderabad: National Institute of Nutrition; 1978. NIN (National Institute of Nutrition) (1978) pp. 134–6.
10. Visweswara Rao RK, Radhiah G, Raju SVS. Association of growth status and prevalence of anemia in pre-school children. Ind J Med Res. 1980;71:237–46.
11. Singla PN, Gupta HP, Ahuja C, Agarwal KN. Deficiency anemia in preschool children-estimation or prevalence based on response to haematinic supplementation. J Trop Pediatr. 1982;28:77–80.
12. Chellan R, Paul L. Prevalence of iron-deficiency anemia in India: results from a large nationwide survey. J Pop Soc Stu. 2010;19:59-80
13. Maheshwari BK, Raut P, Agarwal SK, Joshi U, Dhirhe TC, Gahine R. A study on the Iron status in Iron deficiency anemia one month before and after iron therapy in school going children. J of Clinical and Diagnostic Res 2011;(5)2:324-327.
14. Lozoff B, Klein NK, Nelson EC, et al. Behavior of infants with iron deficiency anemia. Child Dev. 1998;69:24–36.
15. Duque, X., Flores-Hernández, S., Flores-Huerta, S., Méndez-Ramírez, I., Muñoz, S., Turnbull, B., Martínez-Andrade, G., Ramos, R. I., González-Unzaga, M., Mendoza, M. E., & Martínez, H. Prevalence of anemia and deficiency of iron, folic acid, and zinc in children younger than 2 years of age who use the health services provided by the Mexican Social Security Institute. BMC public health,2007; 7, 345.
16. Papagallo. S, Operational problems of an iron supplementation programme for adolescents and children – by UNRWA (UNITED NATIONS RELIEF AND WORK AGENCY).
17. Sachdev. S, A Randomised control trial on directly observed oral iron therapy in rural population, Reva District, Madhya Pradesh – Influence of gastrointestinal side effects of oral iron therapy.
18. Huang SC, Yang YJ, Cheng CN, Chen JS, Lin CH. The etiology and treatment outcome of iron deficiency and iron deficiency anemia in children. J Pediatr Hematol Oncol. 2010 May;32(4):282-5.