Original Article

Study on Nutritional Iron Supplements in Children with Iron Deficiency Anemia in 6 Months to 5 Years Age Group in Nutritional Rehabilitation Centre of Tertiary Care Hospital

Karamsi Nalini[1], Munigangaiah Lalitha[1], Ejju Krishna Chaithanya[2]

[1]Department of Pediatrics, Sri Padmavathi medical college for women, Sri Venkateswara institute of medical sciences, Tirupati, Andhra Pradesh, India.
[2]Assistant Professor, Department of Pathology, Sri Venkateswara Medical College, Tirupati, Andhra Pradesh, India

Abstract

Background: Iron deficiency anemia (IDA) is the most common nutritional disorder worldwide, especially in developing countries. Children between 6 months and 5 years are at high risk due to rapid growth, inadequate dietary iron, and frequent infections. The aim is to evaluate the effect of dietary recommendations and iron-rich traditional food supplementation on hemoglobin (Hb) levels in children with iron deficiency anemia. **Material and Methods:** A prospective observational study was conducted in 400 children (6 months–5 years) admitted to the Nutritional Rehabilitation Centre, Department of Pediatrics, Government General Hospital, Kurnool, Andhra Pradesh. Mild to moderate IDA cases were included. Hemoglobin levels were measured at baseline, and at 3, 6, and 9 months. Nutritional counseling and iron-rich diet supplementation were given. Data were analyzed using SPSS v16 and STATA v10. **Results:** The mean baseline Hb was 8.04 ± 0.31 g/dl, which increased to 8.39 ± 0.31 g/dl at 3 months, 8.74 ± 0.32 g/dl at 6 months, and 9.06 ± 0.30 g/dl at 9 months ($p < 0.001$). Hb gain was significantly higher in term infants, exclusively breastfed children, and those from middle socioeconomic groups. Positive correlations were observed between Hb gain and anthropometric measures (weight, height, MAC). **Conclusion:** Nutritional iron-rich supplementation significantly improved hemoglobin levels, though children remained mildly anemic after 9 months. Dietary modification, along with fortification strategies, is essential to bridge the iron gap during complementary feeding.

Keywords: Iron deficiency anemia, nutrition, hemoglobin gain, children, dietary counseling.

Received: 05 June 2025 **Revised: 10 July 2025** **Accepted: 29 August 2025** **Published: 12 September 2025**

INTRODUCTION

Iron deficiency anemia (IDA) is the most widespread nutritional disorder globally, affecting an estimated 30% of the world's population, predominantly in developing countries. It is particularly prevalent among infants and young children due to increased physiological requirements during growth phases. Hemoglobin levels <11 g/dl in children indicate anemia.[1,2] Inadequate dietary intake, poor bioavailability of non-heme iron, and reliance on plant-based diets further aggravate the problem.

IDA impairs physical growth, cognitive development, immunity, and work capacity. Approximately 2 billion people worldwide are anemic, with nearly half attributed to iron deficiency. India ranks among the countries with the highest prevalence of anemia, reflecting widespread under nutrition and poor dietary practices.[3,4]

Breast milk, although low in iron content, provides highly bioavailable iron compared to cow's milk. Exclusive breastfeeding, followed by timely complementary feeding with iron-rich foods or fortified products, is essential. Preventive measures include iron supplementation from four months of age, iron-fortified formula, limited cow's milk intake, and dietary diversification.[5]

This study was designed to evaluate the effect of dietary recommendations and iron-rich traditional food supplementation on Hb levels in children with IDA admitted to a tertiary care Nutritional Rehabilitation Centre.

Aim and Objectives

The aim of this study was to evaluate the role of simple dietary recommendations in the management of iron deficiency anemia among children aged 6 months to 5 years attending the Nutritional Rehabilitation Centre of a tertiary care hospital. The specific objectives were to provide simple, culturally acceptable, and locally available dietary recommendations for the treatment of iron deficiency anemia, and to determine the mean hemoglobin (Hb) gain score of patients after three, six, and nine months of dietary intervention.

Address for correspondence: Dr. Munigangaiah Lalitha,
Assistant Professor, Department of Pathology, Sri Venkateswara Medical College,
Tirupati, Andhra Pradesh, India
E-mail: drlalitha21@gmail.com

DOI:
10.21276/amit.2025.v12.i3.43

How to cite this article: Nalini K, Lalitha M, Chaithanya EK. Study on Nutritional Iron Supplements in Children with Iron Deficiency Anemia in 6 Months to 5 Years Age Group in Nutritional Rehabilitation Centre of Tertiary Care Hospital. Acta Med Int. 2025;12(3):97-103.

Materials and Methods

Study Setting: The present study was conducted among children aged between 6 months and 5 years admitted to the Nutritional Rehabilitation Centre (NRC), Department of Pediatrics, Government General Hospital, Kurnool, Andhra Pradesh.

Study Design and Duration: This was a prospective observational study carried out over a period of 18 months.

Sample Size: Based on earlier studies, the prevalence of iron deficiency anemia in children was taken as 20%. The sample size was estimated using the formula:

N=4PQ/L2=400

Where, P = prevalence (20%), Q = (100 – P), and L = allowable error at the 95% confidence level. The calculated sample size was 400 children.

Inclusion Criteria: The study included children aged between 6 months and 5 years who were diagnosed with iron deficiency anemia as per standard treatment guidelines. Only those with mild to moderate IDA who were not on hematinic drugs were enrolled.

Exclusion Criteria: Children with severe anemia were excluded from the study, as well as those with anemia associated with comorbid conditions such as sepsis, chronic diarrhea, or malabsorption disorders. Cases of anemia resulting from causes other than iron deficiency, including hemolyticanemia, and chronic illnesses, were also not considered for enrollment.

Ethical Considerations: Ethical clearance was obtained from the Institutional Ethics Committee of Kurnool Medical College, Kurnool. Informed consent was obtained from the caregivers after explaining the study objectives and procedures in their local language.

Method of Study: At baseline, a detailed history was obtained for each child, including demographic information such as age, gender, and place of residence, along with socio-economic status, dietary patterns, and relevant medical history including worm infestation, prior blood transfusions, and chronic illnesses. A complete clinical examination was performed, which included anthropometric measurements (weight, height/length, and mid-upper arm circumference), assessment of pallor, systemic examination, and evaluation for hepatosplenomegaly.

Laboratory investigations comprised a complete blood count with estimation of hemoglobin, hematocrit, mean corpuscular volume (MCV), red cell distribution width (RDW), RBC count and peripheral smear examination. At the time of admission, caregivers received individualized counselling with the aid of a culturally appropriate diet chart, focusing on the inclusion of iron-rich foods. Management of nutritional anemia was carried out exclusively through dietary modification, without the use of medicinal iron supplementation. Deworming was administered to all children at enrollment.

Hemoglobin estimation was repeated at three, six, and nine months to monitor hematological response. The dietary intervention emphasized locally available iron-rich foods, including green leafy vegetables, ragi malt with jaggery, sprouted legumes, and animal sources such as meat, poultry, and fish.

Dietary Recommendations: All caregivers received individualized counseling supported by a culturally appropriate diet chart that emphasized the use of locally available, iron-rich foods. The recommended dietary plan included both vegetarian and non-vegetarian options to ensure flexibility and adherence. Foods commonly advised were green leafy vegetables, ragi malt with jaggery, germinated legumes, sprouts, peanuts, dry fruits, and animal protein such as meat and poultry. The diet chart provided to caregivers is summarized in [Table 1].

Table 1: Sample diet chart provided to caregivers

Meal	Menu
Early morning	Ragi malt with jaggery or multigrain porridge with one boiled egg
Breakfast	Wheat/millet chapati or ½ cup cooked spinach
Lunch	½ cup rice with ½ cup lentil dal (vegetarian) or cooked meat/chicken
Mid-afternoon	Germinated sprouts or soaked peanuts and dry fruits
Dinner	Two wheat/millet chapatis with boiled amaranth/cauliflower

Outcome Measures: The primary outcome of the study was the mean hemoglobin (Hb) gain score at three, six, and nine months following the initiation of dietary recommendations. Secondary outcomes included changes in anthropometric indices, the association of Hb gain with demographic and nutritional variables, and the correlation between Hb gain and improvements in anthropometric measures.

Statistical Analysis: Data were analyzed using descriptive and inferential statistics. Demographic and categorical variables were summarized as frequencies and percentages, while hemoglobin (Hb) levels were expressed as mean, median, and standard deviation. Differences in Hb gain between male and female children were assessed using the Mann–Whitney U-test, whereas anthropometric differences by gender were evaluated using the Student's independent t-test. Changes in mean Hb levels at baseline, three months, six months, and nine months were compared using repeated-measures analysis of variance (ANOVA), and post-hoc pairwise comparisons were conducted with the Bonferronit-test. For qualitative pre–post comparisons, McNemar's test was applied.

Correlation analyses were carried out using Pearson's correlation coefficient to explore the relationship between Hb gain and anthropometric parameters, including weight, height, and mid-arm circumference. Associations between Hb gain and demographic or clinical variables were further examined using one-way ANOVA and independent t-tests.

All analyses were performed using SPSS version 16.0, STATA version 10, and Epi Info version 3.5.1. A p-value of less than 0.05 was considered statistically significant. Results were presented graphically using bar diagrams, pie charts, multiple bar diagrams, and scatter plots with regression estimates.

Results

A total of 400 children aged between 6 months and 5 years were enrolled in the study. The baseline demographic and clinical characteristics are summarized in [Table 2].

In terms of age distribution, half of the study population belonged to the 13–24 month age group (50%), followed by 6–12 months (27.5%), 25–36 months (14.8%), 37-48 months (5.0%), and 49–60 months (2.8%). Thus, the majority were infants and toddlers under two years of age.

Of the enrolled children, 160 (40%) were males and 240 (60%) were females. The mean age of male children was 20.12 ± 11.53 months, while females had a mean age of 19.13 ± 10.99 months. This difference was not statistically significant (Mann–Whitney U-test, p = 0.29).

With respect to gestational history, 317 (79.3%) children were born at term, while 83 (20.8%) were preterm. Regarding feeding practices, 301 (75.3%) children were exclusively breastfed up to 6 months, while 99 (24.8%) were top-fed. Preterm status and top feeding were significantly associated with lower hemoglobin gain scores.

Clinical history revealed that pica was present in 52 children (13.0%), and worm infestation was reported in 49 children (12.3%). Nearly all families were non-vegetarian (99%), with only a very small proportion (1%) reporting a purely vegetarian diet.

Nutritional and socioeconomic status assessment showed that the majority of children were severely acutely malnourished (SAM, 68.3%), followed by moderately acutely malnourished (MAM, 28.5%). Most children belonged to the lower socio-economic class (67.5%), while 32.5% were from middle-class families.

Table 2: Baseline characteristics of study participants (n = 400)

Variable	Category	n (%)
Age (months)	6–12	110 (27.5)
	13–24	200 (50.0)
	25–36	59 (14.8)
	37–48	20 (5.0)
	49–60	11 (2.8)
Gender	Male	160 (40.0)
	Female	240 (60.0)
Gestation	Term	317 (79.3)
	Preterm	83 (20.8)
Feeding type	Exclusively breastfed	301 (75.3)
	Top-fed	99 (24.8)
History	Pica	52 (13.0)
	Worm infestation	49 (12.3)
Socioeconomic status	Lower	270 (67.5)
	Middle	130 (32.5)

Clinical Examination: On clinical evaluation, all children presented with pallor (100%) at baseline. All participants received structured iron-rich dietary counseling, and adherence to the recommended foods was observed during follow-up visits.

Anthropometry: The mean weight of the children was 7.05 ± 1.66 kg, mean height 73.19 ± 9.38 cm, and mean mid-arm circumference (MAC) 12.05 ± 0.77 cm (Table-3). Male children had significantly higher weight, height, and MAC compared to females (p< 0.05).

Table 3: Correlation between Hb gain and anthropometry

Variable	Mean ± SD	r-value	p-value
Age (months)	19.5 ± 11.2	0.29	0.01
Weight (kg)	7.05 ± 1.66	0.44	<0.001
Height (cm)	73.2 ± 9.4	0.36	<0.001
Mid-arm circumference (cm)	12.05 ± 0.77	0.31	0.01

Hemoglobin Trends

At admission, the mean hemoglobin (Hb) concentration was 8.04 ± 0.31 g/dL. Following dietary intervention, there was a progressive improvement:

- At 3 months: 8.39 ± 0.31 g/dL
- At 6 months: 8.74 ± 0.32 g/dL
- At 9 months: 9.06 ± 0.30 g/dL

The overall mean Hb gain from baseline to 9 months was +1.02 g/dL, which was statistically significant (Repeated measures ANOVA, F = 472.59, p< 0.001).

Table 4: Mean hemoglobin (Hb) values at different time points

Time point	Mean Hb (g/dl)	Mean difference vs. baseline	p-value
Baseline	8.04 ±0.31	–	–
3 months	8.39 ±0.31	0.35	0.01
6 months	8.74 ±0.32	0.70	<0.001
9 months	9.06 ±0.30	1.02	<0.001

Classification of Patients Based on peripheral smear: Out of 400 children studied, the majority of peripheral smears showed microcytic hypochromic anemia (81.5%), followed by normocytic normochromic anemia (10.75%), while 7.7% haddimorphic anemia.

Table 5: Classification of Patients Based on peripheral smear		
Category	**n**	**%**
Microcytic hypochromic	326	81.5 %
Normocytic normochromic	43	10.75 %
Dimorphic	31	7.73 %
Total	400	100 %

Association betweenHb Gain and Demographic/Clinical Variables [Figure 1] illustrates the distribution of hemoglobin (Hb) gain scores across key demographic and clinical variables. A significant association was observed with age, with older children showing greater Hb gain ($p < 0.001$). Gestational age was also influential, as term-born children demonstrated significantly higher Hb improvement compared with preterm infants ($p < 0.001$). Feeding practices had a strong effect, with exclusively breastfed children achieving greater Hb gain than those who were top-fed ($p < 0.001$).

Clinical history further influenced outcomes: children without pica or worm infestation had significantly higher Hb gains compared with those with these conditions ($p < 0.05$). Nutritional status was another important determinant, as Hb gain was higher among Grade I and moderately malnourished (MAM) children compared to those with severe acute malnutrition (SAM) ($p < 0.001$). Socioeconomic status also played a role, with children from middle-class families showing greater improvement in Hb than those from lower-class households ($p < 0.001$).

No statistically significant associations were observed with gender or with vegetarian versus non-vegetarian dietary status.

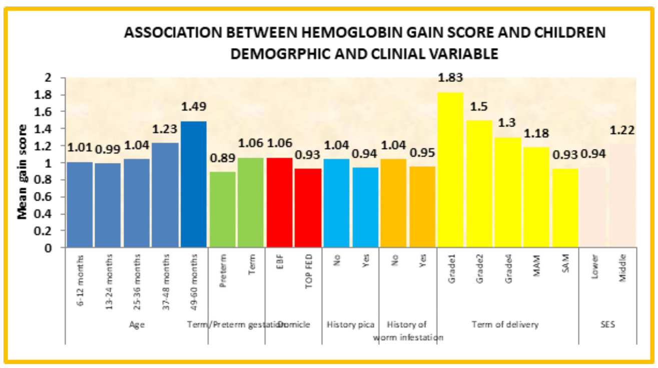

Figure 1: Association between hemoglobin gain scores and children's demographic and clinical variables.

Correlation between hemoglobin gain and anthropometric measures: Hemoglobin (Hb) gain was found to be positively correlated with several anthropometric parameters. A fair positive correlation was observed with age ($p < 0.01$), while a moderate positive correlation was noted with weight ($p < 0.001$). Both height and mid-arm circumference (MAC) also demonstrated fair positive correlations with Hb gain ($p < 0.001$ and $p < 0.01$, respectively). These findings suggest that improvements in growth parameters were closely associated with better hematological outcomes.

[Figure 2–5] present scatter plots with regression lines illustrating the relationship between Hb gain and (i) age, (ii) weight, (iii) height, and (iv) MAC.

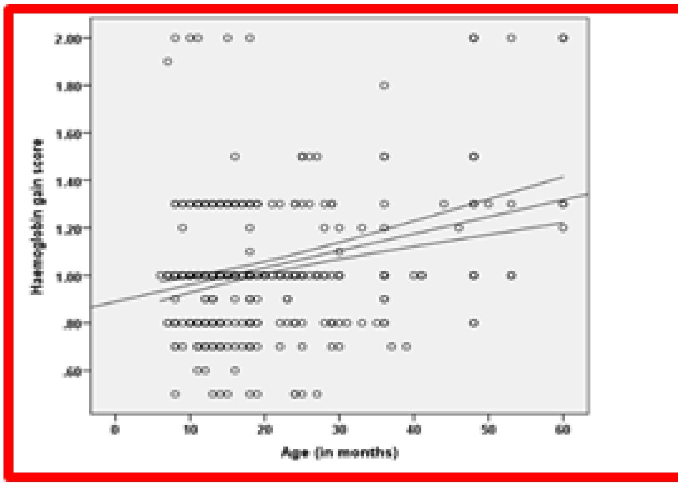

Figure 2: Correlation between Hb gain and age

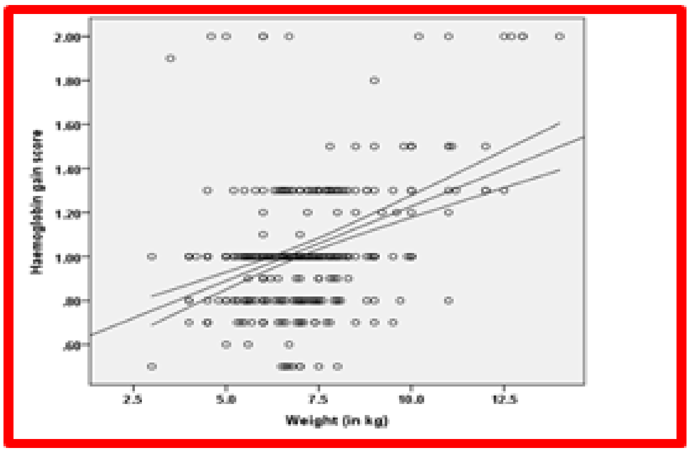

Figure 3: Correlation between Hb gain and weight

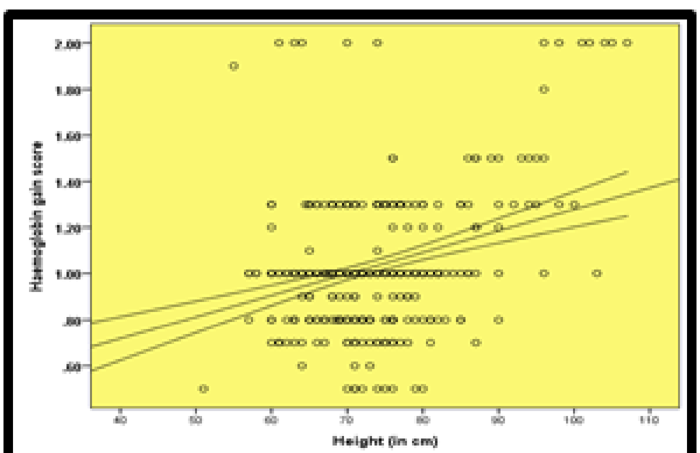

Figure 4: Correlation between Hb gain and height

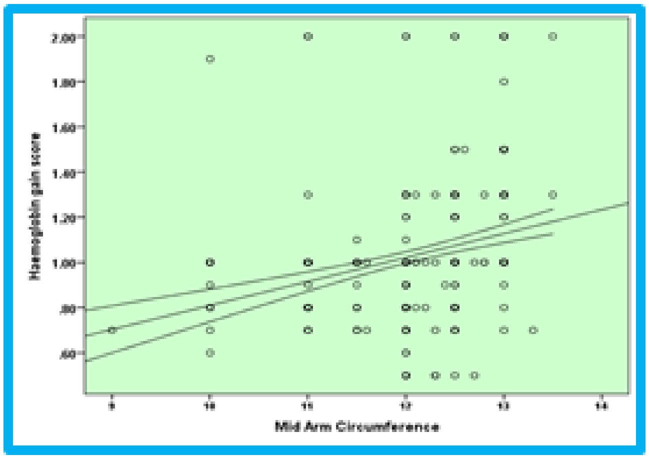

Figure 5: Correlation between Hb gain and mid-arm circumference (MAC).

Discussion

India has the largest proportion of underweight children, almost double compared to that in sub-Saharan Africa.[6,7] Iron deficiency is the most common micronutrient deficiency in the world, affecting many children in developing countries. It is highly prevalent in the first two years of life due to the maximum iron requirement during this period.[8,9] During infancy and childhood, these deficiencies are associated with low birth weight, higher mortality rates, impaired mental development, increased risk of chronic disease, frequent infections, inadequate catch-up growth, and reduced productivity.[8]

The quality of food consumed by infants is often limited; hence, it is imperative to provide optimum nutrition at every meal. Home-based meals may not be adequate, particularly when diets are predominantly vegetarian or contain inhibitors of iron absorption.[10] It is therefore essential to provide iron fortification or dietary modifications to meet iron requirements during complementary feeding. Infants utilize their iron stores during the first six months of life, after which the stored iron becomes depleted, and breast milk alone is insufficient to meet the increased iron demands. This creates a nutrient gap during the transition from breastfeeding to complementary feeding.[9,10] Foods that promote iron absorption include those rich in ascorbic acid and fermented or germinated products, while foods high in phytates, polyphenols, or unmodified cow's milk inhibit absorption.[10] Even complementary foods such as rice, leafy vegetables, fish, beans, and porridge, when provided along with breast milk, often fail to meet infants' iron requirements, leaving an iron gap of up to 45%.[11] A recent meta-analysis of 18 randomized controlled trials including 5,468 children demonstrated that micronutrient-fortified milk and cereal products significantly increased hemoglobin levels by 0.87 g/dL and reduced anemia risk by 57% compared with non-fortified foods.[11]

Age- and Gender-wise Distribution: In our study, half the children were in the 13–24 month age group, followed by 27.5% in the 6–12 month group. This finding is consistent with earlier studies showing that anemia is most common in children below 24 months.[12-14] Dutta et al,[13] and Quaderi et al,[14] reported that anemia prevalence was highest in 6–23 months, with lower prevalence in older preschoolers. Gender differences were not statistically significant in our study, which is also consistent with most previous reports.[12,13] However, Quaderi et al,[14] observed slightly higher anemia prevalence in males, while Onyemaobi et al,[15] in Nigeria also found the most affected age group to be 12–23 months. Rigetti et al,[16] confirmed that infants have the highest prevalence of anemia (78.1%), largely due to depleted iron stores and inadequate complementary feeding.

Term and Preterm Distribution: In our study, 20.8% of children were preterm, and they showed significantly lower Hb gain compared to term children. Preterm infants are known to be at higher risk of IDA due to smaller blood volumes, reduced ferritin concentrations, impaired gastrointestinal absorption, and increased blood losses from frequent phlebotomy.[17]

Feeding Practices: Exclusive breastfeeding (EBF) was reported in 75.3% of children, while 24.8% were top-fed. Children who were exclusively breastfed showed greater Hb gains. Early introduction of unmodified cow's milk is a known risk factor for IDA, as it contains low iron, poor bioavailability, and can cause intestinal blood loss.[18] Sutcliffe et al,[17] also reported an increased risk of iron deficiency among children with prolonged bottle feeding due to excess cow's milk intake.

Clinical History: Pica and Worm Infestation

In our study, 13% of children had a history of pica, and 12.3% had worm infestation. Both were associated with significantly lower Hb gain. Pica is strongly linked to iron deficiency, both as a cause and as a manifestation.[19-21] Gupta and Sadhna,[19] reported lower serum iron levels in children with pica, while Singhi et al,[20] found significantly lower Hb in children with pica compared to controls. Acharya et al,[21] and Coltman,[22] further confirmed the association, showing that pica symptoms improve rapidly with iron supplementation, even before anemia resolves. Worm infestation, on the other hand, contributes to chronic blood loss and impaired absorption, which explains the reduced Hb recovery in these children.[23]

Nutritional and Socioeconomic Status: Most children in our study were severely acutely malnourished (68.3%) or moderately malnourished (28.5%). Hb gain was highest among Grade I and MAM children compared to SAM, highlighting the role of nutritional status in hematological recovery. Socioeconomic disparities were also evident: children from middle-class families had greater Hb gain compared to those from lower-class families. Plessow et al,[24] demonstrated that children from poor households, especially in rural areas, bear the greatest burden of IDA, although severe anemia is also disproportionately high in low-income urban families.

Correlation with Growth Parameters: Hb gain correlated positively with age, weight, height, and mid-arm circumference in our study. This indicates that improvements in nutritional growth are closely linked to hematological recovery, emphasizing the integrated role of nutrition in anemia management.

Comparison with Other Dietary Interventions: Our findings align with intervention trials using fortified complementary foods. Hotz and Gibson,[25] demonstrated that nutrition education promoting enriched porridges significantly improved iron intake in Malawian infants. Similarly, Dhingra et al,[26] showed fortified milk reduced anemia prevalence in peri-urban Indian children, while Faber et al,[27] reported improvements with fortified maize porridge in South Africa. Unlike these studies, our intervention relied solely on locally available iron-rich foods without fortification, yet still achieved a significant Hb improvement of +1.02 g/dL, underscoring the effectiveness of culturally acceptable, low-cost dietary strategies.

Classification of Patients Based on peripheral smear: Out of 400 children studied, the majority of peripheral smears showed microcytic hypochromic anemia (81.5%), followed by normocytic normochromic anemia (10.75%), while 7.7% had dimorphic anemia.

This distribution indicates that microcytic anemia is the predominant morphological type in the studied population. Microcytosis is most often associated with iron deficiency anemia, which is the most common nutritional anemia in children, particularly in developing regions.[28] The high prevalence of microcytosis may reflect poor dietary intake of iron, chronic infections, or parasitic infestations such as hookworm, which are highly prevalent in resource-limited settings. On the other hand, dimorphicanemia (7.7%) is considerably higher than expected in pediatric cohorts. This finding may suggest folate or vitamin B12 deficiency, which are common in populations with inadequate intake of animal proteins, green leafy vegetables, and fortified foods. Other causes such as hypothyroidism, hemolyticanemia with reticulocytosis, or chronic liver disease could also contribute and may warrant further evaluation. The normocytic group (10.7%) could include cases of anemia of chronic disease, hemolyticanemia, or early stages of nutritional anemia before morphological changes manifest.[29]

Strengths and Limitations: Strengths of this study include a large sample size, prospective design, and nine-month follow-up. The focus on dietary modification rather than supplementation enhances programmatic applicability. Limitations include the absence of a control group, possible recall bias on dietary adherence, and lack of biochemical markers (serum ferritin, transferrin saturation). Also coexisting vitamin B12 and folate deficiency in the study population could not be ruled out.

Conclusion

The present study demonstrates that structured dietary counseling with locally available iron-rich foods significantly improves hemoglobin levels in children aged 6 months to 5 years with IDA. The greatest benefits were seen in term infants, exclusively breastfed children, and those without comorbid risk factors such as pica and worm infestation. Hb gain also correlated positively with growth indicators, underscoring the synergistic effect of improved nutrition on hematological recovery. Dietary interventions, therefore, represent a sustainable, culturally acceptable, and effective strategy to complement national iron supplementation programs in reducing the burden of childhood anemia in India.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Kolarš B, MijatovićJovin V, Živanović N, Minaković I, Gvozdenović N, DickovKokeza I, et al. Iron Deficiency and Iron Deficiency Anemia: A Comprehensive Overview of Established and Emerging Concepts. Pharmaceuticals. 2025;18(8):1104.
2. Kebede SS, Asmelash D, Duguma T, Wudineh D, Alemayehu E, Gedefie A, et al. Global prevalence of iron deficiency anemia and its variation with different gestational age systematic review and meta-analysis. Clinical Nutrition Open Science. 2025;59:68-86.
3. Ebrahim Zahra NA, Elsayed Ahmed EA, Abdel-Mordy MA. Iron Deficiency Anemia: Evidence Based Prevention Program among Primary School Students according to 100 Million Health Initiative. Egyptian Journal of Nursing and Health Sciences. 2025;6(2):160-81.
4. Obeagu GU, Altraide BO, Obeagu EI. Iron deficiency anemia in pregnancy and related complications with specific insight in Rivers State, Nigeria: a narrative review. Annals of Medicine and Surgery. 2025;87(6):3435-44.
5. Gao Y. Common Causes and Nutritional Interventions for Infant and Toddler Anemia. Medical and Health Research. 2025;2(6)
6. World Health Organization. Worldwide prevalence of anaemia 1993–2005: WHO global database on anaemia. Geneva: WHO; 2008.
7. International Institute for Population Sciences (IIPS) and ICF. National Family Health Survey (NFHS-5), 2019–21: India. Mumbai: IIPS; 2021.
8. Black RE, Victora CG, Walker SP, et al. Maternal and child undernutrition and overweight in low-income and middle-income countries. Lancet. 2013;382(9890):427–51.
9. Lozoff B, Beard J, Connor J, Felt B, Georgieff M, Schallert T. Long-lasting neural and behavioral effects of iron deficiency in infancy. Nutr Rev. 2006;64(5 Pt 2):S34–S43.
10. Dewey KG, Chaparro CM. Session 4: Mineral metabolism and body composition iron status of breast-fed infants. ProcNutr Soc. 2007;66(3):412–22.
11. Hurrell RF, Egli I. Iron bioavailability and dietary reference values. Am J ClinNutr. 2010;91(5):1461S–1467S.
12. Eichler K, Wieser S, Rüthemann I, Brügger U. Effects of micronutrient fortified milk and cereal food for infants and children: systematic review. BMC Public Health. 2012;12:506.
13. Dutta M, Bhise M, Prashad L, Chaurasia H, Debnath P. Age-specific prevalence of anemia among children 6–59 months in India: Evidence from National Family Health Survey–4. ClinEpidemiol Glob Health. 2020;8(4):1078–83.
14. Quaderi HR, Hoque MM, Kabir ARML, et al. Anemia in children under 5 years attending a tertiary care hospital in Dhaka, Bangladesh. Bangladesh J Child Health. 2016;40(3):147–52.
15. Onyemaobi G, Onimawo I, Ukegbu P, Anyika J. Prevalence of anaemia among preschool children in Imo State, Nigeria. Niger J Paediatr. 2014;41(2):89–93.
16. Roganovic J, Starinac K. Iron deficiency anemia in children. Acta Med Croatica. 2015;69(2):95–100.
17. Sutcliffe TL, Khambalia A, Westergard S, Jacobson S, Peer M, Parkin PC. Iron deficiency in young Canadian children. J Pediatr. 2016;168:153–157.e1.
18. Yadav D, Chandra J. Iron deficiency: beyond anemia. Indian J Pediatr. 2011;78(1):65–72.
19. Gupta N, Sadhna S. Serum iron levels in children with pica: A case-control study. Indian J Pediatr. 2009;76(6):613–6.

20. Singhi S, Singhi P, Adwani GB. Role of pica in iron-deficiency anemia in children. Indian Pediatr. 2003;40(9):896–901.
21. Acharya A, et al. Hematological profile of children with pica. Indian J Hematol Blood Transfus. 2007;23(3–4):121–124.
22. Coltman CA. Pagophagia and iron deficiency anemia. South Med J. 1969;62(5):593–8.
23. Carlander A. Geophagia and iron-deficiency anemia. Acta Med Scand. 1959;165:337–9.
24. Plessow R, Arora NK, Brunner B, Wieser S. Social costs of iron deficiency anemia in 6–59-month-old children in India. PLoS One. 2015;10(8):e0136581.
25. Hotz C, Gibson RS. Participatory nutrition education and adoption of new feeding practices in Malawi. Food Nutr Bull. 2005;26(3):204–12.
26. Dhingra U, Hiremath G, Menon V, et al. Effect of fortified milk on anemia in young children: a randomized controlled trial. Indian Pediatr. 2004;41(9):895–900.
27. Faber M, Kvalsvig JD, Lombard CJ, Benadé AJS. Effect of a micronutrient-fortified maize porridge on anemia and micronutrient status of infants. Am J ClinNutr. 2005;82(5):1032–9.
28. Sastry DC, CP V. Study on clinical and hematological profile of Anemia in children aged 5 to 12 years in rural Telangana. Pediatr. Rev. Int. J. Pediatr. Res. 2017;4(7):488-93.
29. Bain BJ, Bates I, Laffan MA, Lewis SM. Dacie and Lewis practical haematology: expert consult: online and print. Elsevier Health Sciences; 2016:8-17.