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# COMPARISON OF THE EFFICACY OF ORAL AND IV IRON THERAPY IN THE TREATMENT OF IRON DEFICIENCY ANEMIA IN CHILDREN

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**ABSTRACT**

**Background:** One of the most prevalent types of nutritional deficiency among children globally, and in particular the developing nations, is iron deficiency anemia (IDA). It is connected to poor development in physical growth, poor immunity, and poor neurocognitive outcomes. Even though the use of oral iron therapy is rampant as an initial intervention therapy, its attack has generally been compromised by low adherence rates, gastrointestinal side effects, and lack of absorption. The use of intravenous (IV) iron therapy has increasingly been regarded as an alternative to it because it replaces iron in a brief time but in an efficient way.

**Objective:** To compare the mean hemoglobin concentration between oral iron therapy vs intravenous iron therapy in children suffering from iron deficiency anemia.

**Methods:** This was a randomized controlled trial, which was conducted in the Department of Pediatrics in Sir Ganga Ram hospital, Lahore that was carried out during August 2025 and November 2025, including 60 children aged between 1 and 16 years old with IDA diagnosis. There were two groups of participants. Group A was fed on oral iron (iron hydroxide polymaltose complex), and Group B was fed on intravenous iron SEO. The level of hemoglobin was measured at baseline and re-data were taken on day 14 and day 28 after the therapy had been initiated. Data were subjected to the pertinent statistical tests, and a p-value of 0.05 was considered important.

**Results:** The two groups improved in the levels of hemoglobin but the increment was much higher in the intravenous group at both points of follow up ( $p < 0.001$). By 28 days, the average increase in hemoglobin levels rose significantly in patients who were administered IV iron than those who were placed under oral treatment, a result that, clearly, demonstrated a quicker and more efficient hematolog response.

**Conclusion:** IV iron treatment is more effective compared to oral iron in producing quick restoration in haemoglobin concentration in children with IDA. It is also a useful alternative especially when oral therapy fails or is poorly tolerated.

**KEYWORDS:** Iron Deficiency Anemia; Oral Iron; Intravenous Iron; Pediatric Anemia; Hemoglobin; Iron Sucrose

## INTRODUCTION

Iron deficiency anemia (IDA) is a common nutritional and medical disorder, particularly in the third world. The global prevalence of IDA has not been well established but it is evident that a number of preschool children are infected (30–40%) (1). An estimate of 0–4 year olds at 30% and 5–14 year olds at 48% demonstrate a trend of anemic children in developing countries (2).

In reality, iron deficiency, iron deficiency anemia and anemia are some of the terms that are used interchangeably yet they are a process. Iron deficiency can exist as anemia is nonexistent, but serious (3). Deficiency of iron is a gradual process. Iron depletion is first brought about by iron deficiency. Red blood cells have low serum iron concentration,

iron saturation and ferritin and normal hemoglobin. This causes iron deficiency to result in negative iron balance, reduced hemoglobin production and anemia (4,5).

Anemia is considered to be less than the fifth percentile of red blood cell count or hemoglobin concentration by age and sex (6,7). Therefore, specific reference ranges age- and sex-specific are required (8,9). Iron deficiency anemia (IDA) is the most prevalent form of anemia and this is common at the time of growth (infancy and puberty) (10,11).

In children, the clinical manifestation of IDA is pallor, lethargy, weakness during exercise, rapid heart rate and nail defect (koilonychia) (12). The brain has an impact on iron deficiency. Longitudinal analysis has shown that iron deficiency during infancy has effects on cognitive and motor functioning and behavioural issues (13–15). Lozoff et al. discovered that children with iron deficiency were not as active and were passive and had a low level of social interactions some of which lasted up to ten years (13).

The neurocognitive effects remain uncertain as to how and how much iron deficiency interacts with the brain itself; although it has been established that iron deficiency does impair dopaminergic receptors, myelination and enzymes involved in brain processes (14,15,17). Infections may also happen, as iron is also needed by the immune system (18,19).

Oral iron has been the traditional treatment of IDA, has low-cost, and is convenient, but it may be ill maintained, engulfed and submissive (8,20). The use of intravenous iron that allows to replenish iron stores faster is a new development (20). Various studies have shown that intravenous iron is best compared to oral iron. Indicatively, Razzaq et al. discovered that intravenous iron singly was more effective (87.8%) than oral iron (65.8%) (21). In a similar manner, Das et al. found an increase in the hemoglobin content greater after 28 days of intravenous iron compared to oral iron (22).

In this way, the present research will compare the efficacy of either orally administering iron and intravenous iron administration to children with iron deficiency anemia in terms of average hemoglobin.

**OBJECTIVE**

To compare the mean hemoglobin concentration between oral iron therapy vs intravenous iron therapy in children suffering from iron deficiency anemia.

## METHODOLOGY

This was a randomized controlled trial, which was conducted in the Department of Pediatrics in Sir Ganga Ram hospital, Lahore, from August 2025 to November 2025. A total of 60 children (1-16 years) with iron deficiency anaemia was randomly allocated to two groups. A group of one (A) was given oral iron (iron hydroxide polymaltose complex) and the other group was given intravenous iron sucrose. The frequency was seven weeks on iron. Day 0, 14, 28 A complete blood count (CBC) was done to measure the level of hemoglobin on Day 0, 14, and 28. This was observed and compared in the effect of both the treatments.

**INCLUSION CRITERIA**

Children aged between 1 and 16 years of either gender who were diagnosed with iron deficiency anemia were included in the study.

**EXCLUSION CRITERIA**

Children with chronic kidney disease (stage greater than III), chronic heart failure (New York Heart Association Class III and IV), or a known allergy to iron were excluded from the study.

**DATA COLLECTION PROCEDURE**

Parents or guardians of these kids were requested to give written informed consent and children were randomly assigned to two groups. The initial blood hemoglobin of the children was determined. Calculation of iron needs of the children was done. Group A children were to receive iron by mouth on every alternate day whereas Group B children received iron by infusion (investigating iron-secrose) every fourth day over seven weeks. The hemoglobin was repeated after 14 days and 28 days. The data was recorded using a pro forma. The patients were enquired on compliance and side effects.

**DATA ANALYSIS**

Analysis of data was done using SPSS version 20. Continuous variables (mean hemoglobin and age) were given mean and standard deviation (SD), and gender in frequencies and percentages. Independent sample t-test was used to analyse the outcome (mean hemoglobin). We employed within group analysis by the use of paired t-test. We compared the data based on age and sex. A p-value of 0.05 or less was taken to be significant. To be compared more the results were tabulated and plotted in a graph.

## RESULTS

Our sample consisted of 60 children with iron deficiency anemia and children were categorized under two groups (30 children were taking oral iron [Group A] and 30 children were taking intravenous iron [Group B]) as well. The mean age was 7.2 ± 3.6 years, and 55% were males. No differences were found among the two groups.

**Baseline Characteristics**

| Parameter | Total (n = 60) |
|---|---|
| Mean Age (years) | 7.2 ± 3.6 |
| Gender Distribution | Male: 33 (55%) |
| | Female: 27 (45%) |
| Group Allocation | Oral Iron: 30 |
| | Intravenous Iron: 30 |
| Baseline Hb (g/dL) | Oral: 7.1 ± 0.6 |
| | IV: 7.0 ± 0.5 |

We divided the sample into two corresponding groups, which were similar at baseline ($p > 0.05$).

**Hemoglobin Levels at Follow-up**

| Time Point | Oral Iron (Group A) | IV Iron (Group B) | p-value |
|---|---|---|---|
| Baseline | 7.1 ± 0.6 | 7.0 ± 0.5 | 0.62 |
| Day 14 | 8.4 ± 0.7 | 9.6 ± 0.6 | <0.001 |
| Day 28 | 9.8 ± 0.8 | 11.4 ± 0.7 | <0.001 |

The hemoglobin of both groups improved considerably with time; however, intravenous iron group had a higher response at day 14 and day 28 ($p < 0.001$).

**Mean Hemoglobin Increase (Baseline to Day 28)**

| Group | Mean Increase (g/dL) | p-value |
|---|---|---|
| Oral Iron (n = 30) | 2.7 ± 0.8 | |
| IV Iron (n = 30) | 4.4 ± 0.9 | <0.001 |

The change in hemoglobin, between day 28 and the baseline, was significant in the intravenous iron group than in the oral iron group.

**Adverse Effects**

| Outcome | Oral Iron | IV Iron |
|---|---|---|
| Mild GI Side Effects | 6 (20%) | 0 |
| Infusion-related Reactions | 0 | 2 (6.7%) |
| Serious Adverse Events | 0 | 0 |

No severe negative incidents. The oral iron group had some mild gastrointestinal symptoms and the intravenous iron group had some mild reactions.

**Interpretation**

We have demonstrated that intravenous iron therapy is even better compared to oral iron in increasing the hemoglobin level in children with iron deficient anemia. More rapid and higher rise of the hemoglobin concentration was observed with intravenous iron at 14 days and 28 days. Tolerability of both forms of iron was good, but oral iron (gastrointestinal) and intravenous iron (infusion reaction) had some minor side effects and no severe adverse events. We have observed that intravenous iron therapy caused an increased faster rise of the hemoglobin concentration in comparison to oral iron therapy, and is an alternative therapy, especially when we desire the hemoglobin concentration to increase briskly and/or in those patients who are intolerant to oral iron.

## DISCUSSION

We noted an increase in hemoglobin concentration among intravenous iron therapy-treated children with iron deficiency anemia that was higher and faster than children with oral iron therapy. The two time points exhibited an incremental and higher concentration of hemoglobin in children who were administered intravenous iron, indicating that intravenous iron is more effective in the short term in treating anemia. We agree that our results are in line with the other findings (21,22).

The study by Razzaq et al. revealed that intravenous iron was much effective as compared to oral iron in terms of response (87.8% vs 65.8%) (21). On the same note, Das et al. indicated that the mean hemoglobin level four weeks into iron treatment, especially when the iron was administered intravenously, was significantly better than with oral

iron (22). The results of these studies and our study contribute to the evidence of the use of intravenous iron in response to treatment.

This could be due to iron absorption and iron utilisation. Gut absorption of iron may be erratic and may be influenced by food, gut functionality and oral iron adherence (8,20). Side effects like nausea, constipation and stomach pain can be caused by iron, thus affecting adherence (8,20). Nevertheless, iron in the gut is not absorbed and is introduced into the blood directly and the amount of iron consumed is injected (4,20).

The second problem is the implications of iron deficiency on growth and development. The brain needs iron in order to myelinate and to create neurotransmitters (13). Cognitive and motor delay and behavioural problems can be caused by iron deficiency in the growth years (13–15). These can even turn out to be permanent, although anaemia is resolved later on (16). Therefore, a faster method of treating iron deficiency can be desirable.

Lastly was the fact that the two strategies were safe. No severe side effects. However, in the oral iron group, there were milder side effects (8,20). Intravenous iron had mild and tolerable side effects, and therefore can be administered safely in the hospital.

However, there are drawbacks of the intravenous iron. It must be administered by a worker in hospital and it is more costly than oral iron. This could restrict its access, particularly in resource deprived environments within low and middle-income countries. Therefore, oral iron is the treatment of first choice especially in mild to moderately iron deficient anemia.

Lastly, the study contributes to the existing body of evidence that intravenous iron is superior to oral iron in iron deficiency anemia treatment in children, particularly when there is a need to achieve a quick response, or oral iron is subject to intolerance. The larger and longer term studies in the future would be beneficial in informing about the long term effects of iron use and use in other clinical settings.

## CONCLUSION

Anemia is a common disease among children and iron deficiency anemia has negative effects on development. We demonstrate that IV iron is better than oral iron in quick increase of hemoglobin. Oral iron is cheaper, easier to administer, with a poor absorption and adherence.

IV iron is safe and tolerable, particularly when the rapid rise in hemoglobin is requisite, or oral iron is not working. It is costly and requires someone, who has been trained to administer it, but there are numerous benefits.

Our study reveals that doctors should consider such patient characteristics like the level of anemia and reaction to treatment when using the iron deficiency anemia in children management.

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