JHWCR JOURNAL OF HEALTH, WELLNESS AND COMMUNITY RESEARCH 3007-0570

https://doi.org/10.61919/f1vvm572

Original Article

Comparison of Intravenous with Oral Iron in Management of Iron Deficiency Anemia in Pregnancy

Bibi Fozia[1], Farah Naz[1], Safia Bibi[2], Muhammad Arif Khan[3], Zareena[1]

[1] FCPS Gynae and OBS Postgraduate Resident, Bolan Medical Complex Hospital, Quetta, Pakistan

[2] Professor, Gynae Unit 4, Bolan Medical Complex Hospital, Quetta, Pakistan

[3] MS General Surgeon, Civil Hospital, Quetta, Pakistan

***Corresponding author: Bibi Fozia, Foziakhan760@gmail.com**

"Cite this Article" Received: 03 May 2025; **Accepted**: 24 June 2025; **Published**: 19 July 2025

Author Contributions: Concept: BF; Design: FN; Data Collection: SB and ZA; Analysis: MAK; Drafting: BF and FN. **Ethical Approval**: Bolan Medical College Quetta, Quetta, Pakistan**. Informed Consent**: Written informed consent was obtained from all participants; **Conflict of Interest**: The authors declare no conflict of interest. **Funding**: No external funding; **Data Availability**: Available from the corresponding author on reasonable request; **Acknowledgments**: N/A.

ABSTRACT

Background: Iron deficiency anemia is a common nutritional disorder during pregnancy and is associated with adverse maternal and perinatal outcomes. Oral iron is widely used, but poor adherence, gastrointestinal intolerance, and slow replenishment of iron stores may limit its effectiveness. Objective: To compare the therapeutic effectiveness of intravenous iron sucrose and oral ferrous sulphate in pregnant women with iron deficiency anemia. Methods: This comparative clinical study was conducted in the Department of Obstetrics and Gynecology, Bolan Medical Complex Hospital, Quetta, from October 15, 2024, to April 16, 2025. One hundred pregnant women with iron deficiency anemia were allocated into two equal groups. Group A received oral ferrous sulphate, while Group B received intravenous iron sucrose. Hemoglobin and serum ferritin were measured before treatment and after three weeks. Results: Mean hemoglobin increased from 9.32 ± 0.63 to 10.32 ± 0.62 g/dL in the oral iron group and from 8.82 ± 1.01 to 10.91 ± 1.20 g/dL in the intravenous iron group. The mean hemoglobin rise was greater with intravenous iron than oral iron (2.09 ± 0.51 vs 1.00 ± 0.36 g/dL; $p<0.001$). Serum ferritin increased by 21.76 ± 5.97 µg/L in the intravenous group compared with 2.95 ± 0.88 µg/L in the oral group ($p<0.001$). Conclusion: Intravenous iron sucrose was more effective than oral iron in improving hemoglobin and serum ferritin levels in pregnant women with iron deficiency anemia. Keywords: Iron deficiency anemia; pregnancy; intravenous iron; oral iron; iron sucrose; serum ferritin.

INTRODUCTION

Iron deficiency anemia remains one of the most frequent nutritional disorders affecting pregnant women and continues to represent a major maternal and fetal health concern in low- and middle-income settings. During pregnancy, physiological expansion of plasma volume, increased red cell mass, fetal iron requirements, and blood loss around delivery increase maternal iron demand, making women particularly vulnerable when baseline nutritional reserves are already depleted. In Pakistan and comparable regional settings, the burden is further intensified by poor dietary iron intake, repeated pregnancies, inadequate antenatal supplementation, gastrointestinal intolerance to oral iron, and delayed health-seeking behavior. Iron deficiency anemia during pregnancy is clinically important because it is associated with maternal fatigue, reduced functional capacity, increased susceptibility to obstetric complications, low birth weight, preterm birth, impaired neonatal iron stores, and increased perinatal morbidity (1–3).

Oral iron therapy remains widely used because it is inexpensive, accessible, and generally effective in mild to moderate iron deficiency anemia. However, its therapeutic value is often reduced by poor gastrointestinal tolerability, limited absorption, drug–food interactions, slow hematologic response, and poor adherence, especially when rapid correction is required before delivery. Intravenous iron therapy

provides a biologically direct alternative by bypassing gastrointestinal absorption and replenishing iron stores more rapidly, thereby supporting erythropoiesis within a shorter clinical timeframe. Previous studies have reported that intravenous iron sucrose can produce greater improvement in hemoglobin concentration and serum ferritin compared with oral iron therapy, although some studies have shown variable differences in hemoglobin response, suggesting that local population characteristics, baseline anemia severity, gestational age, adherence, and dosing protocols may influence treatment outcomes (4–6).

Despite the availability of international and regional evidence, locally generated comparative data from antenatal populations in Quetta remain limited, particularly studies assessing both hemoglobin response and ferritin restoration after a defined short-term treatment period. This evidence gap is clinically relevant because treatment decisions in busy antenatal units often depend not only on statistical efficacy but also on feasibility, speed of response, tolerability, and the ability to restore iron reserves before childbirth. Therefore, a local comparative evaluation of oral versus intravenous iron therapy can provide practical evidence for optimizing anemia management in pregnant women attending tertiary care services.

This study was conducted to compare the therapeutic effectiveness of intravenous iron sucrose and oral ferrous sulphate in pregnant women with iron deficiency anemia by assessing changes in hemoglobin concentration and serum ferritin after three weeks of treatment. The study hypothesis was that intravenous iron therapy would produce a significantly greater rise in hemoglobin and serum ferritin levels than oral iron therapy among pregnant women with iron deficiency anemia.

MATERIALS AND METHODS

This comparative clinical study was conducted in the Department of Obstetrics and Gynecology, Bolan Medical Complex Hospital, Quetta, from October 15, 2024, to April 16, 2025. The study enrolled pregnant women attending the antenatal clinic and obstetric ward who were diagnosed with iron deficiency anemia. Eligible participants were pregnant women with gestational age between 12 and 32 weeks, hemoglobin concentration between 7 and 10 g/dL, and serum ferritin below 12 µg/L. Women were excluded if they were unwilling to participate in follow-up, had anemia due to causes other than iron deficiency such as megaloblastic or hemolytic anemia, had renal or hepatic disease, or had a known hypersensitivity to iron preparations.

A total of 100 eligible pregnant women were recruited after informed consent and allocated into two equal treatment groups using a random number table. Group A received oral iron therapy, while Group B received intravenous iron sucrose therapy. Baseline assessment included demographic information, obstetric history, gestational age confirmation using clinical history and ultrasonography, body weight measurement, hemoglobin concentration, and serum ferritin level. The primary outcome was change in hemoglobin concentration after three weeks of treatment, while the secondary outcome was change in serum ferritin level after three weeks. Baseline variables including age, weight, gestational age, pretreatment hemoglobin, and pretreatment ferritin were recorded to assess group comparability and potential confounding.

Participants in the oral iron group received ferrous sulphate 300 mg three times daily, equivalent to 60 mg elemental iron per tablet. Participants in the intravenous iron group received iron sucrose in divided doses. The total iron requirement was calculated using the formula: iron requirement = hemoglobin deficit × body weight × 2.21 + 1000 mg, where the additional 1000 mg represented replenishment of iron stores. Intravenous iron was administered in 200 mL normal saline over approximately one hour on alternate days after an initial test dose and clinical monitoring. All participants were reassessed after three weeks, and hemoglobin and serum ferritin measurements were repeated using the same laboratory procedures to maintain consistency.

To reduce selection bias, participants meeting the eligibility criteria were enrolled consecutively and then allocated using a random number table. To reduce measurement bias, pre-treatment and post-treatment hemoglobin and ferritin were assessed using standardized laboratory methods. Baseline differences between groups, particularly gestational age, body weight, and pretreatment hemoglobin, were considered clinically relevant because they could influence treatment response. Therefore, the final analysis was planned to include both within-group comparisons and between-group comparisons of mean change, with additional adjusted analysis recommended for baseline imbalances where applicable.

Data were analyzed using SPSS version 23. Quantitative variables including age, weight, gestational age, hemoglobin, and serum ferritin were summarized as mean and standard deviation. Within-group pre-treatment and post-treatment differences in hemoglobin and ferritin were assessed using paired-sample t-tests. Between-group differences in mean change in hemoglobin and serum ferritin were assessed using independent-sample t-tests. Normality of continuous variables was assessed before applying parametric tests. Where baseline differences were statistically significant, analysis of covariance was considered appropriate to adjust post-treatment outcomes for baseline values and relevant covariates. A p-value of ≤ 0.05 was considered statistically significant, and exact p-values were reported where possible; values smaller than 0.001 were reported as $p<0.001$ rather than $p=0.00$.

Ethical approval was obtained before study initiation, and written informed consent was taken from all participants. Participant confidentiality was maintained by using anonymized study records, and clinical data were used only for research purposes. Data accuracy was ensured by checking entries against source records, maintaining uniform follow-up timing, and applying the same laboratory parameters before and after treatment. This methodological approach was designed to improve reproducibility, minimize bias, and provide clinically interpretable evidence regarding the comparative effectiveness of oral and intravenous iron therapy in pregnancy.

RESULTS

A total of 100 pregnant women with iron deficiency anemia were included, with 50 participants in each treatment group. Age was comparable between groups, but baseline weight, gestational age, and pretreatment hemoglobin differed significantly, indicating the need to interpret unadjusted comparisons cautiously. Mean pretreatment hemoglobin was higher in the oral iron group than the intravenous iron group, while baseline serum ferritin was similar between groups. After three weeks, both therapies improved hemoglobin and ferritin; however, intravenous iron produced a substantially greater rise in both outcomes. The mean hemoglobin increase was 1.00 ± 0.36 g/dL in the oral group compared with 2.09 ± 0.51 g/dL in the intravenous group, with a between-group mean difference of 1.09 g/dL. Serum ferritin increased by 2.95 ± 0.88 µg/L in the oral group and 21.76 ± 5.97 µg/L in the intravenous group, with a between-group mean difference of 18.81 µg/L. These findings show both statistical and clinical superiority of intravenous iron for short-term correction of anemia and restoration of iron stores.

Table 1. Baseline Characteristics of Study Participants

Variable	Oral Iron Group (n=50), Mean ± SD	Intravenous Iron Group (n=50), Mean ± SD	Mean Difference	95% CI	p-value
Age (years)	32.38 ± 5.93	33.64 ± 4.20	1.26	-0.78 to 3.30	0.224
Weight (kg)	61.06 ± 8.03	53.16 ± 14.45	-7.90	-12.55 to -3.25	0.001
Gestational age (weeks)	27.06 ± 4.18	29.46 ± 2.98	2.40	0.96 to 3.84	0.001
Pretreatment hemoglobin (g/dL)	9.32 ± 0.63	8.82 ± 1.02	-0.50	-0.84 to -0.16	0.004
Pretreatment ferritin (µg/L)	8.34 ± 2.71	8.25 ± 2.73	-0.09	-1.17 to 0.99	0.869

Table 2. Treatment Response After Three Weeks

Outcome	Oral Iron Group (n=50), Mean ± SD	Intravenous Iron Group (n=50), Mean ± SD	Mean Difference	95% CI	Effect Size (Cohen's d)	p-value
Post-treatment hemoglobin (g/dL)	10.32 ± 0.63	10.91 ± 1.20	0.59	0.21 to 0.97	0.62	0.003
Hemoglobin increase (g/dL)	1.00 ± 0.36	2.09 ± 0.51	1.09	0.91 to 1.27	2.47	<0.001
Post-treatment ferritin (µg/L)	11.26 ± 2.88	30.53 ± 7.68	19.27	16.95 to 21.59	3.32	<0.001
Ferritin increase (µg/L)	2.95 ± 0.88	21.76 ± 5.97	18.81	17.10 to 20.52	4.41	<0.001

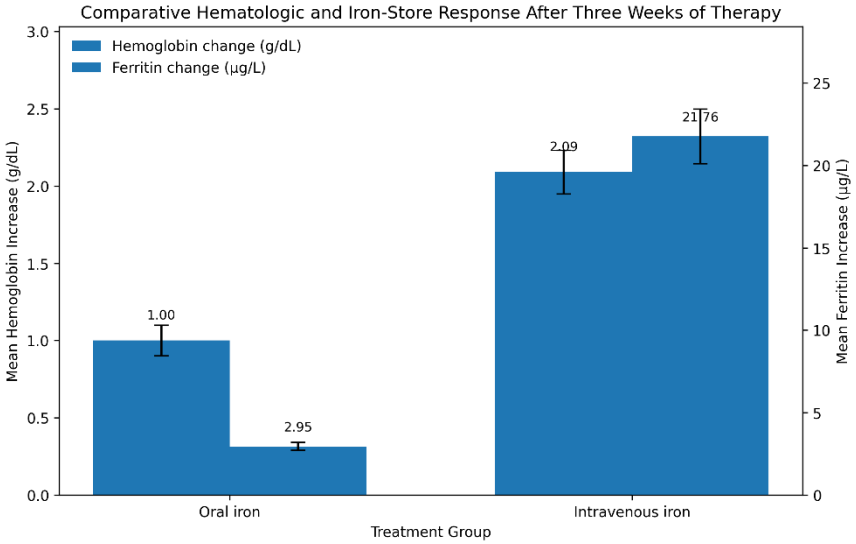

Figure 1 Comparative Hematologic and Iron-Store Response After Three Weeks of Therapy

The figure demonstrates that intravenous iron produced a markedly greater treatment response than oral iron over three weeks, with hemoglobin increasing by 2.09 g/dL compared with 1.00 g/dL and serum ferritin increasing by 21.76 µg/L compared with 2.95 µg/L. The magnitude of benefit was especially pronounced for iron-store restoration, where the ferritin response in the intravenous group was approximately 7.4 times higher than in the oral group, supporting the clinical advantage of intravenous therapy when rapid correction of iron deficiency is required.

DISCUSSION

This study found that both oral and intravenous iron therapy improved hemoglobin and serum ferritin levels after three weeks of treatment in pregnant women with iron deficiency anemia; however, intravenous iron produced a substantially greater therapeutic response. The mean hemoglobin increase was 2.09 ± 0.51 g/dL in the intravenous group compared with 1.00 ± 0.36 g/dL in the oral group, while the mean ferritin increase was 21.76 ± 5.97 µg/L compared with 2.95 ± 0.88 µg/L, respectively. These findings support the biological and clinical rationale that intravenous iron bypasses gastrointestinal absorption limitations and replenishes iron stores more rapidly than oral supplementation, particularly in pregnant women who require timely correction before delivery.

The greater hemoglobin response observed with intravenous iron is consistent with previous reports showing faster hematologic recovery with parenteral iron therapy in pregnancy. Oral iron remains a practical first-line treatment in many antenatal settings because of low cost and accessibility, but its effectiveness is frequently limited by gastrointestinal side effects, poor adherence, reduced absorption, and food-related interactions. In contrast, intravenous iron sucrose allows controlled delivery of the calculated iron deficit and supports more rapid erythropoiesis, which is particularly relevant when pregnancy is advanced or baseline anemia is clinically significant (4–6). The marked ferritin response in the intravenous group is also clinically important because restoration of iron stores reduces the likelihood of recurrent anemia and may improve maternal reserve before childbirth.

The present findings are broadly aligned with studies reporting superior improvements in hemoglobin and ferritin following intravenous iron therapy compared with oral iron. Similar comparative studies have shown that intravenous iron sucrose produces faster correction of iron deficiency anemia and better replenishment of iron stores, although some published evidence has reported less pronounced differences in hemoglobin response. Such variability may reflect differences in baseline hemoglobin, gestational age, anemia severity, follow-up duration, adherence to oral therapy, and total iron dosing protocols (5,16,17). In the current study, the improvement in serum ferritin was particularly large in the intravenous group, suggesting that intravenous therapy may offer greater advantage for iron-store restoration than for hemoglobin correction alone.

An important methodological consideration is that the two groups were not fully balanced at baseline. Weight, gestational age, and pretreatment hemoglobin differed significantly between groups, and the intravenous group had a lower mean baseline hemoglobin level. This imbalance may influence the magnitude of treatment response and should be addressed using adjusted analysis, preferably analysis of covariance controlling for baseline hemoglobin, gestational age, and body weight. Although the unadjusted findings strongly favor intravenous iron, adjusted estimates would provide more reliable evidence of independent treatment effect.

This study has several limitations. The sample size was modest, follow-up was limited to three weeks, and longer-term maternal and neonatal outcomes were not assessed. Treatment adherence in the oral iron group was not objectively reported, and adverse effects were not systematically compared between groups. The absence of blinding may also introduce performance or assessment bias. Despite these limitations, the study provides useful local evidence from a tertiary care antenatal population and supports the clinical value of intravenous iron when rapid correction of iron deficiency anemia is required.

CONCLUSION

Intravenous iron sucrose was more effective than oral ferrous sulphate in improving hemoglobin concentration and serum ferritin levels among pregnant women with iron deficiency anemia over a three-week treatment period. Although oral iron remains useful for many patients because of its accessibility and low cost, intravenous iron offers a clinically stronger option when rapid correction is required, oral therapy is poorly tolerated, or iron stores need prompt replenishment before delivery. Future studies should include larger samples, longer follow-up, systematic adverse-effect reporting, and adjusted analyses to confirm the independent treatment effect of intravenous iron.

REFERENCES

1. Al Hassan NN. The prevalence of iron deficiency anemia in Saudi University female students. J Microsc Ultrastruct. 2015;3(1):25-8.

2. Wali A, Mushtaq A, Nilofer B. Comparative study: efficacy, safety and compliance of intravenous iron sucrose and intramuscular iron sorbitol in iron deficiency anemia of pregnancy. J Pak Med Assoc. 2002;52:392-5.

3. Perewusnyk G, Huch R, Huch A, Breymann C. Parenteral iron therapy in obstetrics: 8 years' experience with iron-sucrose complex. Br J Nutr. 2002;88:3-10.

4. Hasan S, Hashim B, Sultana A. Iron therapy in iron deficiency anemia in pregnancy: intravenous iron sucrose versus oral iron hydroxide polymaltose complex in anemia. Ann Abbasi Shaheed Hosp Karachi Med Dent Coll. 2003;8:435-40.

5. Bayoumeu F, Subiran-Buisset C, Baka NE, Legagneur H, Monnier-Barbarino P, Laxenaire MC. Iron therapy in iron deficiency anemia in pregnancy: intravenous route versus oral route. Am J Obstet Gynecol. 2002;186:518-22.

6. Tabassum R, Ashfaq S, Khan N. Place of intravenous iron sucrose for the treatment of iron deficiency anemia during pregnancy. Med Channel. 2003;9:55-6.

7. Hercberg S, Galan P, Praul A, Preziosi P. Epidemiology of iron deficiency anemia in the French population. Ann Biol Clin. 1998;56:49-52.

8. World Health Organization. The prevalence of anemia in women: a tabulation of available information. 2nd ed. Geneva: World Health Organization; 1992.

9. Pritchard JA. Hemoglobin regeneration in severe iron deficiency anemia: response to orally and parenterally administered iron preparation. JAMA. 1966;195:717-20.

10. Allen LH. Anemia and iron deficiency: effects on pregnancy outcome. Am J Clin Nutr. 2000;71:1280-4.

11. Mungen E. Iron supplementation in pregnancy. J Perinat Med. 2003;31:420-6.

12. Gravier A, Descargues G, Marpeau L. How to avoid transfusion in postpartum period: importance of an intravenous iron supplement. J Gynecol Obstet Biol Reprod. 1999;28:77-8.

13. Krafft A, Breymann C, Huch R, Huch A. Intravenous iron sucrose in two pregnant women with inflammatory bowel disease and severe iron deficiency anemia. Acta Obstet Gynecol Scand. 2000;79:720-2.

14. Sal Momen AK, Al Meshari A, Al Nuaimen L. Intravenous iron sucrose complex in the treatment of iron deficiency anemia during pregnancy. Eur J Obstet Reprod Biol. 1996;69:121-4.

15. Broche DE, Gay C, Armand-Branger S, Grangeasse L, Terzibachian JJ. Acute postpartum anemia: clinical practice and interest of intravenous iron. Gynecol Obstet Fertil. 2004;32:613-9.

16. Halimi S, Halimi SMA, Sohaib M. Oral versus parenteral iron therapy for correction of iron deficiency anemia in pregnancy. Gomal J Med Sci. 2011;9:3-5.

17. Al RA, Unlubilgin E, Kandemir O, Yalvac S, Cakir L, Haberal A. Intravenous versus oral iron for the treatment of anemia in pregnancy. Obstet Gynecol. 2005;106(6):1335-40.

18. Breymann C, Richter C, Huttner C, Huch R, Huch A. Effectiveness of recombinant erythropoietin and iron sucrose versus iron therapy only in patients with postpartum anemia and blunted erythropoiesis. Eur J Clin Invest. 2000;30:154-61.

19. Zubair S, Mahmud G, Tasnim N. Experience with intravenous iron sucrose in pregnant women. Med Spectr. 2001;22(7-8):27.

20. Soomro MS, Karina KA. Iron binding capacity and transferrin saturation in pregnancy. Pak J Med Sci. 1998;14:315-8.