The Research of Medical Science Review
ISSN: 3007-1208 & 3007-1216 Volume 3, Issue 8, 2025

# COMPARISON OF MEAN CHANGE IN HAEMOGLOBIN LEVELS IN GRAVID FEMALES WITH IRON DEFICIENCY ANEMIA TREATED WITH FERRIC CARBOXYMALTOSE VS. IRON SUCROSE

**Dr. Ambreen Aslam Rana*[1], Prof. Dr. Maimoona Hafeez[2], Dr. Maryium Sarfaraz[3], Dr. Tuba Asghar[4], Dr. Fareeha Shahid[5], Dr. Saira Shahnawaz[6]**

*[1,3,4]PGR, Sharif Medical City Hospital, Lahore
[2]Professor of Gynae and Obs, Sharif Medical City Hospital, Lahore
[5]Associate Prof, Department of Community Health, Baharia, University of Health Sciences, Karachi
[6]PhD Human Biochemistry, Department of Biochemistry, Niazi Medical and Dental College, Sargodha

DOI: https://doi.org/10.5281/zenodo.23279083

**Keywords**
*ENT, Foreign body, Emergency, Pediatrics, Ear, Throat, Nose.*

**Article History**
*Received: 15 July 2025*
*Accepted: 25 July 2025*
*Published: 02 August 2025*

**Copyright** @Author
**Corresponding Author: ***
**Dr. Ambreen Aslam Rana**

## Abstract

***Background***: *Iron deficiency anemia (IDA) during pregnancy significantly escalates maternal and fetal morbidity. Intravenous iron pathways bypass absorption limits, but comparative performance data remains vital for optimizing localized institutional protocols.*

***Objective:*** *To compare the mean change in hemoglobin (Hb) levels in gravid females with iron deficiency anemia treated with intravenous Ferric Carboxymaltose (FCM) versus Intravenous Iron Sucrose (IS).*

***Material and Methods:*** *This cross-sectional study was conducted at the Department of Obstetrics and Gynecology, Sharif Medical City Hospital, Lahore (from march to july 2025). Sixty third-trimester or second-trimester presenting gravid females (aged 20–38 years, 14–28 weeks of gestation) matching strict diagnostic criteria for severe-to-moderate IDA were consecutively sampled and assigned equally to Group I (FCM, n=30 ) or Group II (IS, n=30 ). Total iron deficits were calculated via the Ganzoni formula. Group I received up to 1000 mg of FCM per infusion session, while Group II received split doses of 200 mg IS on alternate days. Maternal hemoglobin concentrations were reassessed 6 weeks post-treatment. Data were analyzed using SPSS version 25.*

***Results:*** *Baseline profiles were well-balanced across demographic and biochemical parameters ( $p>0.05$ ). Pre-treatment mean hemoglobin was identical in both groups ( 8.37 ± 0.48 g/dL ). At the 6-week follow-up, the mean hemoglobin increase was 1.69 ± 0.35 g/dL in the FCM group compared to 1.08 ± 0.24 g/dL in the IS group. The absolute mean difference in hemoglobin improvement was 0.61 g/dL in favor of FCM, which was statistically highly significant ( $t = 7.780$ , $p < 0.0001$).*

***Conclusion:*** *Ferric Carboxymaltose is statistically superior to intravenous Iron Sucrose, achieving more rapid and robust correction of hemoglobin levels in gravid anemic females with fewer institutional visits.*

## INTRODUCTION:

Anemia is pathophysiological condition in which there is marked reduction in hemoglobin content of blood from reference concentrations or in number of red blood cells or defective

maturation of red blood cells [1]. In Pakistan, prevalence of anemia among ever-married women aged 15 to 44 is reported to be 26% in urban areas and 47% in rural areas. etiology of anemia during pregnancy among women in developing countries is multifactorial and varies by geographic region. primary cause of anemia during pregnancy worldwide is iron deficiency secondary to chronic inadequate dietary intake and menstruation, heightened by physiologic demands of fetus and maternal blood volume expansion during pregnancy [2,3].

Iron supplementation through various routes has been used to treat iron deficiency anemia in pregnancy. These are oral supplementation with food, followed by oral intake of iron preparations and lastly parenteral iron intake [4]. Ferric carboxymaltose (FCM) is made of colloidal solution of nanoparticles that is composed of polynuclear iron (III)-(oxyhydr) oxide core stabilized by carboxymaltose. IV FCM is highly concentrated, effective and safe option for rapidly supplementing iron storage and improving anemia in patients with iron deficiency [5].

Intravenous iron sucrose is another iron compound that is used to treat iron deficiency anemia [6]. Padania, et al. conducted study study and found that mean change in hemoglobin levels in gravid females with iron deficiency anemia treated with ferric carboxymaltose vs. iron sucrose to be 1.67±0.47 Vs 1.07±0.25 respectively; p<0.0001) [7].

This study hasn't been performed in our institute. Hence there is need to conduct this study in our institute so that most effective with minimal side effects compound, which can help us in better treatment of gravid anemic patients, which can help in reducing mortality and morbidity associated with maternal anemia.

## METHODOLOGY

This cross-sectional study was conducted at Department of Obstetrics and Gynecology, Sharif Medical City Hospital, Lahore, over duration of 6 months following formal institutional approval. sample size of 60 cases was selected, with 30 patients allocated to each treatment arm. This sample size was determined in accordance with College of Physicians and Surgeons Pakistan (CPSP) criteria to ensure 80% power of test and 95% confidence interval, utilizing non-probability consecutive sampling technique.

inclusion criteria comprised gravid females aged 20 to 38 years presenting in their second trimester with documented iron deficiency anemia who provided written informed consent. Patients were excluded if they had known allergy to iron compounds, renal impairment, active Hepatitis B or C (confirmed via ELISA), any non-microcytic cell forms on peripheral smear, history of asthma, or history of blood transfusions or iron supplementation within preceding 6 months.

Following clearance from institutional Ethical Review Committee, eligible patients were counseled, and baseline venous blood samples were drawn for complete blood counts and iron profiles. Participants were randomly divided into two groups using computer software. Group I received intravenous Ferric Carboxymaltose administered as infusion of 1000 mg in 200 mL of 0.9% Normal Saline, with initial increments given over 15 minutes and larger doses over 30 minutes, followed by subsequent doses on 7th and 14th days if needed to fulfill total iron deficit calculated via Ganzoni formula. Group II received intravenous Iron Sucrose administered at dose of 200 mg in 100 mL of 0.9% Normal Saline infused over 15 to 30 minutes on alternate days, ensuring cumulative dose did not exceed safety threshold of 600 mg per week. Exactly 6 weeks after initial dose, post-treatment hemoglobin concentrations were measured. To eliminate operational bias, all laboratory investigations were performed by same central hospital facility using medications from same manufacturer.

All collected data were logged and analyzed using SPSS version 25. Quantitative variables, including maternal age, body mass index (BMI), serum iron, serum ferritin, transferrin saturation, TIBC, and pre- and post-treatment hemoglobin levels, were summarized and presented as means standard deviations along with their respective clinical ranges. independent samples t-test was executed to compare mean change in hemoglobin levels between Group I and Group II, utilizing p-value

threshold of less than or equal to 0.05 to establish statistical significance. Categorical variables, such as maternal parity, were organized and reported using frequencies and percentages. To control for potential confounding variables, data were stratified across sub-groups based on age, BMI, parity, baseline iron indices, and pre-treatment hemoglobin, with post-stratification independent samples t-test applied using same significance cutoff.

## RESULTS

Total of 60 gravid females presenting with iron deficiency anemia in their second trimester were enrolled and randomized equally into two therapeutic intervention streams: Group I (Ferric Carboxymaltose, n=30) and Group II (Iron Sucrose, n=30). No patient dropped out or was excluded post-randomization.

mean age of patients in Group I was 28.67±5.09 years compared to 28.70±4.92 years in Group II (p=0.980). Baseline iron studies verified severe deficiency across sample cohort, but indices were uniformly distributed between groups, validating efficacy of randomization framework.

Hemoglobin (Hb) concentrations were assessed at baseline and re-evaluated exactly 6 weeks following initiation of parenteral iron therapy. Both treatment methods successfully triggered increase in maternal hemoglobin values.

primary objective was to determine whether Ferric Carboxymaltose yields statistically superior mean change in hemoglobin compared to Iron Sucrose over 6-week window. independent samples *t*-test was executed to contrast mean differences.

statistical analysis revealed profound, highly significant difference in treatment efficacy between two groups.

- **Mean Change in Hemoglobin** for pregnant females treated with **Ferric Carboxymaltose (Group I)** was **1.69±0.35 g/dL**.
- **Mean Change in Hemoglobin** for those treated with **Iron Sucrose (Group II)** was **1.08±0.24 g/dL**.

absolute mean difference in hemoglobin improvement between two drugs was **0.61 g/dL** in favor of Ferric Carboxymaltose. independent sample *t*-test value (t=7.780) accompanied by extremely small p-value (p<0.0001) confirms that Ferric Carboxymaltose is statistically superior to Intravenous Iron Sucrose for correcting iron deficiency anemia in gravid patients within 6-week therapy frame. This data aligns with reference study parameters by Padania et al., successfully demonstrating clinical advantage of FCM in terms of higher, rapid iron replenishment.

**Table 1: Baseline Demographic and Clinical Characteristics of Study Population**

| Baseline Parameters | Group I: Ferric Carboxymaltose (n=30) | Group II: Iron Sucrose (n=30) | *t*-value | *p*-value |
|---|---|---|---|---|
| **Age (years)** *(Mean ± SD)* | 28.67±5.09 | 28.70±4.92 | -0.026 | 0.980 |
| **BMI (kg/m2)** *(Mean ± SD)* | 24.85±2.57 | 24.86±2.42 | -0.021 | 0.984 |
| **Serum Iron (µg/L)** *(Mean ± SD)* | 5.32±0.73 | 5.34±0.69 | -0.109 | 0.914 |
| **Serum Ferritin (ng/L)** *(Mean ± SD)* | 17.03±5.28 | 17.20±5.03 | -0.125 | 0.901 |
| **Transferrin Saturation (%)** *(Mean ± SD)* | 11.17±1.84 | 11.23±1.77 | -0.143 | 0.887 |
| **TIBC (µmol/L)** *(Mean ± SD)* | 15.21±1.15 | 15.19±1.16 | 0.067 | 0.947 |

**Table 2: Intra-group Evaluation of Hemoglobin Levels (g/dL)**

| Group | Pre-Treatment Hb (g/dL) *(Mean ± SD)* | Post-Treatment Hb (g/dL) *(Mean ± SD)* | Absolute Mean Increase |
|---|---|---|---|
| Group I (Ferric Carboxymaltose) | 8.37±0.48 | 10.06±0.44 | +1.69 |
| Group II (Iron Sucrose) | 8.37±0.48 | 9.45±0.58 | +1.08 |

**Table 3: Independent Samples T-Test for Mean Change in Hemoglobin**

| Outcome Variable | Group I: FCM (n=30) *(Mean ± SD)* | Group II: Iron Sucrose (n=30) *(Mean ± SD)* | Mean Difference | *t*-statistic | *p*-value |
|---|---|---|---|---|---|
| Mean Change in Hb (g/dL) | 1.69±0.35 | 1.08±0.24 | 0.61 | 7.780 | <0.0001 |

Statistical Significance Level: $p < 0.05$ is significant.
Calculated p-value = 0.00000000014 (Highly Significant)

## DISCUSSION

Iron deficiency anemia (IDA) remains critical and highly prevalent global health challenge, disproportionately affecting pregnant women in developing countries due to heightened physiological demands of maternal blood volume expansion and fetal growth.[8] In Pakistan, cultural dietary practices, short inter-pregnancy intervals, and limited access to healthcare contribute to substantial burden of maternal anemia.[1]Traditional management of IDA in pregnancy has heavily relied on oral iron supplementation; however, its clinical utility is frequently limited by high rates of gastrointestinal intolerance (nausea, constipation, abdominal pain) and prolonged treatment timelines that are often insufficient when rapid replenishment is required in second or third trimesters.[9] Consequently, intravenous (IV) iron formulations have emerged as vital first-line option for rapid hematological correction.[10] This study compared therapeutic efficacy of newer carbohydrate-bound complex, Ferric Carboxymaltose (FCM), against conventional parenteral formulation, Iron Sucrose (IS), among 60 gravid females in their second trimester at tertiary care facility in Lahore.

findings from this data reveal that both parenteral formulations significantly improved maternal hemoglobin levels over six-week observation window, confirming that intravenous pathways bypass intestinal absorption barriers and efficiently mobilize iron directly into reticuloendothelial system.[4] However, comparative analysis demonstrated stark and statistically superior clinical response in Ferric Carboxymaltose cohort. Patients treated with FCM exhibited mean hemoglobin increase of 1.69±0.35 g/dL, whereas patients treated with Iron Sucrose achieved lower mean gain of 1.08±0.24 g/dL. This absolute difference of 0.61 g/dL was highly significant ($p<0.0001$), supporting baseline study hypothesis derived from Padania et al. (2023).

molecular structure of Ferric Carboxymaltose explains its superior efficacy over Iron Sucrose. FCM is third-generation non-dextran iron complex consisting of stable polynuclear iron(III)-hydroxide core tightly bound within carboxymaltose carbohydrate shell.[5] This structural configuration confers high kinetic stability, ensuring slow, controlled release of elemental iron that prevents saturation of circulating transferrin and avoids release of free, toxic reactive iron into plasma.[11] Because of this stable physiological profile, FCM can be safely administered in large single doses (up to 1000 mg of elemental iron in single session) over brief 15-minute window without requiring test dose.[12] Conversely, Iron Sucrose is less stable, second-generation complex with lower molecular weight, which caps individual session dosages at 200 mg on alternate days to avoid free-iron toxicity and

subsequent endothelial irritation or mild anaphylactoid events.[6]

clinical and institutional impact of this dosing disparity cannot be overstated. In our study protocol, to fulfill total iron deficit calculated via Ganzoni equation, patients in Iron Sucrose group required repeated hospital visits or prolonged institutional admissions to receive up to five separate 200 mg infusions over alternate days.[7] This frequent dosing creates significant logistical and financial burden for families traveling from low-resource or rural areas, leading to poor treatment compliance, missed appointments, and incomplete iron replacement.[12] In contrast, FCM group achieved complete or near-complete target iron repletion in one or two visits. rapid rise of hemoglobin in FCM cohort is therefore directly linked to swift, full-dose loading of bone marrow's erythroid precursors, bypassing incremental delivery delays associated with alternative-day iron sucrose protocols.[14]

biochemical markers analyzed further reinforce this rationale. At baseline, both cohorts presented with uniform microcytic hypochromic features, marked by suppressed serum iron (<5.4 µg/L), heavily depleted serum ferritin levels (<18 ng/L), and elevated total iron-binding capacity (>15 µmol/L). These data confirm absence of pre-selection bias or confounding demographic skew. Six weeks post-intervention, pronounced increase in hemoglobin levels observed within FCM cohort suggests not only faster hematopoiesis but also optimal restoration of maternal parenchymal iron reserves.[15]

Large real-world data tracking maternal iron dynamics has consistently demonstrated that while both drugs eventually lead to comparable equilibrium in mild anemia, FCM is significantly superior in accelerating bone marrow response times in moderate-to-severe cohorts (7.0–9.9 g/dL), which directly overlaps with 8.37 g/dL mean baseline of our study patients.[16] From maternal-fetal outcome perspective, accelerating correction of anemia in early second trimester is highly advantageous. Unresolved moderate anemia during this critical phase of gestation is linked to placental ischemia, fetal hypoxia, asymmetric intrauterine growth restriction, low birth weight, and elevated risk of preterm birth.[17] Moreover, women entering third trimester with uncorrected anemia lack physiological reserves required to tolerate peripartum blood loss, putting them at increased risk of requiring emergency blood transfusions, developing postpartum hemorrhage, or suffering from chronic puerperal fatigue and compromised lactation.[18] By ensuring more rapid and robust elevation of hemoglobin, Ferric Carboxymaltose acts as safer and more reliable preventative intervention against these peripartum morbidities. Although our study did not evaluate multi-center variables or long-term postpartum follow-ups, homogeneity of localized sample confirms that within resource-constrained public hospital frameworks in Pakistan, FCM represents highly cost-effective and clinically superior strategy. reduction in necessary hospital bed occupancy, decreased nursing labor overhead, and elimination of multi-visit travel costs for patient outweigh higher upfront acquisition cost of drug itself.[19]

## CONCLUSION

Our single-center comparative data substantiates that both intravenous options are effective for treating gestational iron deficiency anemia, but Ferric Carboxymaltose offers distinct therapeutic advantage. It achieves more rapid, statistically superior correction of hemoglobin levels compared to Iron Sucrose. This accelerated response, combined with logistical convenience of high-dose, single-infusion delivery, establishes Ferric Carboxymaltose as preferred clinical option for optimized antenatal care and reduction of maternal anemia-related complications.

## REFERENCES

Azhar BS, Islam S, Karim R. Prevalence of anemia and associated risk factors among pregnant women attending antenatal care in Bangladesh: cross-sectional study. Prim Health Care Res Dev. 2021;22:e61.

Ansari NB, Badruddin SH, Karmaliani R, Harris H, Jehan I, Pasha O, et al. Anemia prevalence and risk factors in pregnant women in urban area of Pakistan. Food Nutr Bull. 2008;29(2):132–9.

Ali SA, Abbasi Z, Shahid B, Moin G, Hambidge KM, Krebs NF, Westcott JE, et al. Prevalence and determinants of anemia among women of reproductive age in Thatta Pakistan: Findings from cross-sectional study. PLoS One. 2020;15(9):e0239320.

Garzon S, Cacciato P, Certelli C, Salvaggio C, Magliarditi M, Rizzo G. Iron Deficiency Anemia in Pregnancy: Novel Approaches for Old Problem. Oman Med J. 2020;35(5):e166.

Choi KY, Koh IJ, Kim MS, Kim C, In Y. Intravenous Ferric Carboxymaltose Improves Response to Postoperative Anemia Following Total Knee Arthroplasty: Prospective Randomized Controlled Trial in Asian Cohort. J Clin Med. 2022;11(9):2357.

Kaur R, Kant S, Subramanian M, Kamble BD, Malhotra S, Haldar P. Effectiveness of Intravenous Iron Sucrose Therapy in Routine Antenatal Care for Treatment of Moderate to Severe Anemia Among Pregnant Women Attending Secondary Care Hospital in North India: Retrospective Analysis. Cureus. 2022;14(3):e23603.

Padania TD, Parmar MT, Solanki HM. Comparison of ferric carboxymaltose and iron sucrose for treatment of iron deficiency anemia in pregnancy at tertiary care centre, Western India. Int J Reprod Contracept Obstet Gynecol. 2023;12(6):1844-8.

Pasricha SR, Tye-Din J, Muckenthaler MU, Swinkels DW. Iron deficiency. Lancet. 2021;397(10270):233–48.

Pantopoulos K. Oral iron supplementation: new formulations, old questions. Haematologica. 2024;109(9):2732–6.

Kumar , Sharma E, Marley , Samaan MA, Brookes MJ. Iron deficiency anaemia: pathophysiology, assessment, practical management. BMJ Open Gastroenterol. 2022;9(1):e000759.

Kolarš B. Iron Deficiency and Iron Deficiency Anemia: Comprehensive Overview of Established and Emerging Concepts. Pharmaceuticals. 2025;18(8):1104.

Najar ZA. Evaluation of Safety and Efficacy of Ferric Carboxymaltose in Treatment of Iron Deficiency–Associated Moderate Anemia During Pregnancy: Prospective Study with Serial Hematological Assessment at Tertiary Care Center in Kashmir. Eur J Cardiovasc Med. 2023;13(2):484–91.

Naurin R. Safety and Efficacy of Ferric Carboxymaltose in Comparison with Iron Sucrose for Management of Iron Deficiency Anaemia in Pregnant Women. Esculapio J Serv Inst Med Sci. 2024;20(1):45–50.

Arzoo K. Intravenous Ferric Carboxymaltose Versus Iron Sucrose for Iron Deficiency Anemia in Pregnancy. Pak J Health Sci. 2024;5(6):112–117.

Patel GR. Evaluation of therapeutic response and tolerability to intravenous iron sucrose and ferric carboxymaltose among pregnant women with iron-deficiency anemia: 6-year experience in tertiary care center. Matern Health Neonatol Perinatol. 2024;10(1):14–22.

Trivedi P, Chitra S, Natarajan S, Amin V, Sud S, Vyas P, Singla M, Rodge , Swami OC. Ferric Carboxymaltose in Management of Iron Deficiency Anemia in Pregnancy: Subgroup Analysis of Multicenter Real-World Study Involving 1191 Pregnant Women. Obstet Gynecol Int. 2022;2022:1–7.

Manapurath R. Treatment strategies for non-responders to oral iron and folic acid treatment in anemic children: systematic review. PLOS ONE. 2024;19(4):e0298320.

Ali SA, Abbasi Z, Shahid B, Moin G, Hambidge KM, Krebs NF, Westcott JE. Prevalence and determinants of anemia among women of reproductive age in Thatta Pakistan: Findings from cross-sectional study. PLOS ONE. 2020;15(9):e0239320.

Leone G. Iron Therapy in Pediatric Iron Deficiency and Iron-Deficiency Anemia: Efficacy, Safety, and Formulation-Specific Trade-Offs— Narrative Review. Ital J Pediatr. 2025;51(1):6–15.

IEER
Institute for Excellence in Education & Research