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PROSPECTIVE EVALUATION OF SERUM FERRITIN AND TRANSFERRIN SATURATION AS PREDICTORS OF HAEMATOLOGICAL RESPONSE TO ORAL IRON THERAPY IN IRON DEFICIENCY ANAEMIA

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ABSTRACT

Background: Iron deficiency anaemia (IDA) is a common haematological disorder associated with significant morbidity. Oral iron supplementation remains the preferred treatment; however, therapeutic response varies among patients. Baseline serum ferritin and transferrin saturation (TSAT) may serve as useful indicators for predicting haematological improvement. **Aim:** To evaluate baseline serum ferritin and transferrin saturation as predictors of haematological response to oral iron therapy in patients with iron deficiency anaemia.

Material and Methods: This prospective observational study included 105 patients with confirmed iron deficiency anaemia at a tertiary care hospital. Patients received oral ferrous sulphate supplementation providing approximately 60–65 mg elemental iron daily. Haematological parameters were assessed at baseline and after 2, 4, and 8 weeks. Serum ferritin and TSAT were reassessed at eight weeks. Data were analysed using SPSS version 27.0. Correlation analysis, ROC curve analysis, and multivariable logistic regression were performed.

Results: Among 105 patients, 61.90% were females, and 87.62% had moderate anaemia. Satisfactory haematological response was observed in 72 patients (68.57%). Mean haemoglobin increased significantly from 9.16 ± 0.83 to 11.31 ± 1.26 g/dL after eight weeks ($p<0.001$). Patients with baseline ferritin ≥10 ng/mL demonstrated higher response rates than those with lower ferritin (80.70% versus 54.17%; $p=0.006$). Similarly, patients with TSAT ≥10% showed better responses (88.57% versus 58.57%; $p=0.002$). The combined ferritin–TSAT model demonstrated an AUC of 0.757. Baseline TSAT (AOR=1.27; $p=0.007$) and haemoglobin (AOR=2.09; $p=0.016$) emerged as independent predictors.

Conclusion: Baseline TSAT and haemoglobin were significant independent predictors of haematological response. Combined assessment of ferritin and TSAT may improve prediction and facilitate individualized management of iron deficiency anaemia.

Keywords: Iron Deficiency Anaemia; Serum Ferritin; Transferrin Saturation; Oral Iron Therapy; Haematological Response.

INTRODUCTION

Iron deficiency anaemia (IDA) is one of the most prevalent nutritional and haematological disorders encountered in clinical practice and remains an important cause of preventable morbidity worldwide. Iron is an essential micronutrient required for haemoglobin synthesis, oxygen transport, cellular respiration, and several metabolic processes necessary for normal physiological functioning. An imbalance between iron requirements and available iron leads to progressive depletion of body iron stores, impaired erythropoiesis, and reduced haemoglobin production. The condition affects

individuals across different age groups, particularly women of reproductive age, people with inadequate dietary intake, and patients experiencing chronic blood loss. Its widespread occurrence, substantial clinical burden, and potentially reversible nature emphasize the importance of timely diagnosis, appropriate management, and effective monitoring of treatment response.[1] The development of iron deficiency anaemia involves interactions between dietary iron intake, gastrointestinal absorption, physiological requirements, and ongoing iron losses. Iron absorption occurs predominantly in the duodenum and proximal jejunum, where its regulation is influenced by systemic iron requirements and hepcidin activity. Hepcidin, a liver-derived hormone, controls iron availability by regulating intestinal absorption and iron release from storage sites. Disturbances in this mechanism may contribute to inadequate iron availability for erythropoiesis. Patients commonly present with fatigue, generalized weakness, dizziness, exertional dyspnoea, palpitations, and reduced exercise tolerance. Haematological abnormalities typically include reduced haemoglobin concentration, microcytosis, hypochromia, and increased red cell distribution width. These manifestations may adversely affect functional capacity, productivity, and overall quality of life.[2] The clinical evaluation of iron deficiency anaemia requires consideration of both its underlying causes and associated haematological abnormalities. Inadequate dietary iron intake, menstrual blood loss, gastrointestinal bleeding, and increased physiological requirements represent important contributing factors. Women of reproductive age are particularly susceptible because of menstrual iron losses and variations in nutritional requirements. A detailed clinical history, dietary assessment, physical examination, and relevant laboratory investigations are essential for establishing the diagnosis. Complete blood count, peripheral blood smear, and biochemical iron parameters provide complementary information regarding anaemia severity and iron availability. Identification of the underlying aetiology is equally important because persistent blood loss, inadequate absorption, or associated nutritional deficiencies may interfere with satisfactory haematological recovery following iron supplementation.[3] Serum ferritin and transferrin saturation (TSAT) are important biochemical indicators used in evaluating iron deficiency. Serum ferritin primarily reflects body iron stores and is considered a useful marker for identifying depleted iron reserves. However, ferritin is also an acute-phase reactant, and its concentration may increase during inflammation, potentially obscuring the diagnosis of iron deficiency. Transferrin saturation, calculated using serum iron and total iron-binding capacity, reflects circulating iron availability for erythropoiesis. Reduced TSAT indicates inadequate iron supply to developing red blood cells. Combined interpretation of serum ferritin, TSAT, haemoglobin concentration, red blood cell indices, and inflammatory markers may improve the evaluation of iron status. These complementary biomarkers may also have potential value in assessing subsequent treatment responsiveness.[4] Accurate identification of iron deficiency and its underlying cause is essential for selecting appropriate treatment strategies. Gastrointestinal blood loss, malabsorption syndromes, coeliac disease, and other digestive tract abnormalities may contribute to persistent or recurrent iron deficiency anaemia. The diagnostic approach should consider patient age, gender, clinical presentation, associated symptoms, and relevant risk factors. Laboratory confirmation of iron deficiency should therefore be accompanied by appropriate clinical investigations to identify potential sources of iron loss or impaired absorption. Recognition of these contributing factors is particularly important in patients who demonstrate inadequate improvement following oral supplementation. Comprehensive evaluation helps distinguish uncomplicated nutritional iron deficiency from conditions requiring additional diagnostic investigations or alternative therapeutic interventions.[5] Oral iron supplementation remains an important first-line treatment for uncomplicated iron deficiency anaemia because of its accessibility, affordability, and established therapeutic role. Ferrous salts, including ferrous sulphate, are commonly prescribed to replenish iron availability and support haemoglobin synthesis. However, treatment effectiveness may be influenced by baseline iron stores, gastrointestinal absorption, medication adherence, dietary factors, and continuing blood loss. Gastrointestinal adverse effects may further compromise treatment compliance. Monitoring haemoglobin concentration during treatment provides an important indication of therapeutic effectiveness, while serial assessment of red blood cell indices and biochemical iron parameters helps evaluate haematological recovery. Early identification of an inadequate response allows clinicians to reconsider treatment adherence, investigate underlying causes, and modify management when necessary.[6]

MATERIALS AND METHODS

The present study was designed as a prospective observational study to evaluate the predictive role of baseline serum ferritin and transferrin saturation (TSAT) in determining haematological response to oral iron therapy among patients diagnosed with iron deficiency anaemia (IDA). The study aimed to assess the relationship between iron status parameters and subsequent improvement in haemoglobin levels following oral iron supplementation. The study was conducted in the Department of General Medicine at a tertiary care hospital. Patients attending the outpatient department and those admitted with a diagnosis of iron deficiency anaemia were considered for enrolment. The study was conducted after

obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants before their inclusion. A total of 105 patients with confirmed iron deficiency anaemia were included in the study. Patients were selected using a consecutive sampling technique based on predefined inclusion and exclusion criteria. All eligible patients underwent baseline clinical assessment and laboratory investigations before initiating oral iron therapy.

Inclusion Criteria

Patients aged 18 years and above, of either gender, with laboratory-confirmed iron deficiency anaemia were included. Anaemia was defined as haemoglobin levels below 13 g/dL in males and below 12 g/dL in non-pregnant females. Iron deficiency was established through reduced serum ferritin levels (less than 30 ng/mL) and/or transferrin saturation below 20%, supported by haematological findings. Patients who were clinically stable, eligible for oral iron supplementation, and willing to participate in follow-up assessments were included.

Exclusion Criteria

Patients with anaemia due to causes other than iron deficiency, including haemolytic anaemia, thalassaemia, aplastic anaemia, and vitamin B12 or folate deficiency, were excluded. Patients with active infections, chronic inflammatory disorders, chronic kidney disease, advanced liver disease, malignancy, or acute significant blood loss were also excluded. Pregnant women, patients receiving intravenous iron therapy, those with recent blood transfusions, and individuals with known intolerance to oral iron preparations were excluded.

Methodology

Detailed demographic and clinical information was collected using a structured proforma. Parameters included age, gender, body mass index (BMI), dietary habits, socioeconomic status, duration of anaemia-related symptoms, and relevant medical history. Clinical manifestations such as fatigue, weakness, pallor, dizziness, exertional dyspnoea, and palpitations were documented. History of gastrointestinal bleeding, menstrual blood loss, previous iron supplementation, and associated comorbidities was recorded. General physical examination and systemic assessment were performed in all participants.

Laboratory Investigations

Baseline laboratory investigations included complete blood count (CBC), haemoglobin concentration, red blood cell count, haematocrit, mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), red cell distribution width (RDW), reticulocyte count, and peripheral blood smear examination. Iron profile assessment included serum ferritin, serum iron, total iron-binding capacity (TIBC), and transferrin saturation. Serum ferritin was measured using an immunoassay method, while serum iron and TIBC were determined using standard biochemical techniques. Transferrin saturation was calculated using the formula: TSAT (%) = (Serum iron/TIBC) × 100. C-reactive protein (CRP) was assessed to identify possible inflammatory influences on serum ferritin levels.

Oral Iron Therapy and Follow-up Assessment

All enrolled patients received oral ferrous sulphate supplementation providing approximately 60–65 mg of elemental iron once daily, according to the institutional treatment protocol. Patients were advised regarding medication adherence, dietary iron intake, and factors affecting iron absorption. Follow-up assessments were performed at 2, 4, and 8 weeks after treatment initiation. Haemoglobin concentration, red cell indices, and reticulocyte response were evaluated during follow-up, while serum ferritin and transferrin saturation were reassessed at 8 weeks. Treatment adherence, gastrointestinal adverse effects, and clinical improvement were documented.

Assessment of Haematological Response

The primary outcome was the change in haemoglobin concentration from baseline to 8 weeks following oral iron therapy. A satisfactory haematological response was defined as an increase in haemoglobin of at least 2 g/dL or achievement of normal haemoglobin levels by 8 weeks. Patients were classified into responders and non-responders based on these criteria. Secondary outcomes included changes in MCV, MCH, RDW, reticulocyte count, serum ferritin, and transferrin saturation. Baseline ferritin and TSAT values were evaluated individually and collectively for their ability to predict treatment response.

Statistical Analysis

Data were entered into Microsoft Excel and analysed using IBM SPSS Statistics version 27.0. Continuous variables were expressed as mean ± standard deviation or median with interquartile range, while categorical variables were presented as frequencies and percentages. The Shapiro–Wilk test was applied to assess normality. Independent Student's t-test or Mann–Whitney U test was used to compare continuous variables between responders and non-responders. Paired t-test or Wilcoxon signed-rank test was used to assess changes in haematological parameters following treatment. Categorical variables were compared using the Chi-square test or Fisher's exact test. Pearson's or Spearman's correlation analysis was performed to assess associations between baseline iron parameters and haemoglobin improvement. Receiver operating characteristic (ROC) curve analysis was used to determine the predictive performance of serum ferritin and TSAT, including area under the curve (AUC), sensitivity, specificity, and optimal cutoff values. Multivariable logistic regression was performed to identify independent predictors of haematological response after adjustment for relevant confounding factors. A p-value less than 0.05 was considered statistically significant.

RESULTS

Table 1: Baseline Demographic and Clinical Characteristics of the Study Participants (N = 105)

Table 1 presents the baseline demographic and clinical characteristics of 105 patients diagnosed with iron deficiency anaemia. The majority of participants belonged to the 31–45 years age group (47.62%), followed by 46–60 years (24.76%) and 18–30 years (21.90%), while only 5.71% were older than 60 years. Females constituted 61.90% of the study population, whereas males accounted for 38.10%. Regarding dietary habits, 51.43% were vegetarian and 48.57% consumed a mixed diet. Fatigue was the most frequently reported symptom (80.95%), followed by pallor (76.19%), exertional dyspnoea (52.38%), palpitations (40.00%), and dizziness (31.43%). Most patients had moderate anaemia (87.62%), while 9.52% had severe anaemia and only 2.86% had mild anaemia.

Table 2: Comparison of Baseline Clinical and Laboratory Parameters Between Responders and Non-Responders

Table 2 compares baseline clinical and laboratory parameters between patients who demonstrated satisfactory haematological response (n=72) and those who did not (n=33). The mean age was lower among responders (39.72 ± 12.37 years) than non-responders (43.06 ± 11.09 years), although the difference was statistically insignificant (p=0.172). Baseline haemoglobin was slightly higher among responders (9.27 ± 0.80 g/dL) compared with non-responders (8.93 ± 0.85 g/dL; p=0.058). Responders demonstrated significantly higher MCH (23.28 ± 1.72 vs. 22.42 ± 1.57 pg; p=0.014), serum ferritin (13.00 ± 5.96 vs. 9.02 ± 4.38 ng/mL; p<0.001), and transferrin saturation (9.25 ± 3.82% vs. 6.21 ± 2.62%; p<0.001). Serum iron was also significantly higher among responders (33.22 ± 13.78 vs. 22.01 ± 9.35 µg/dL; p<0.001). No statistically significant differences were observed in BMI, MCV, RDW, or TIBC between the groups (p>0.05).

Table 3: Changes in Haematological and Iron Profile Parameters Following Oral Iron Therapy (N = 105)

Table 3 demonstrates progressive improvement in haematological parameters following oral iron supplementation over eight weeks. Mean haemoglobin increased significantly from 9.16 ± 0.83 g/dL at baseline to 9.85 ± 0.93 g/dL at two weeks, 10.55 ± 1.06 g/dL at four weeks, and 11.31 ± 1.26 g/dL at eight weeks (p<0.001). Similarly, MCV increased from 73.15 ± 3.39 to 79.20 ± 4.04 fL, while MCH improved from 23.01 ± 1.72 to 25.35 ± 2.11 pg (p<0.001). RDW initially increased at two weeks but subsequently decreased to 15.87 ± 1.46% at eight weeks. Reticulocyte count increased from 0.81 ± 0.16% at baseline to 1.54 ± 0.35% at two weeks, followed by a gradual decline toward baseline levels. Serum ferritin increased from 11.75 ± 5.80 to 25.67 ± 9.17 ng/mL, while transferrin saturation improved from 8.29 ± 3.76% to 17.56 ± 5.66% at eight weeks, with statistically significant changes (p<0.001).

Table 4: Association of Baseline Serum Ferritin and Transferrin Saturation with Haematological Response at 8 Weeks

Table 4 illustrates the association between baseline serum ferritin, transferrin saturation, and haematological response following eight weeks of oral iron therapy. Among 48 patients with serum ferritin below 10 ng/mL, 26 (54.17%) demonstrated satisfactory response, whereas 22 (45.83%) were non-responders. In comparison, among 57 patients with serum ferritin ≥10 ng/mL, 46 (80.70%) responded successfully, demonstrating a statistically significant association (p=0.006). Similarly, among patients with baseline TSAT below 10%, 41 (58.57%) responded, compared with 31 (88.57%) patients with TSAT ≥10%. This association between baseline TSAT and treatment response was statistically significant (p=0.002). Overall, 72 patients (68.57%) achieved satisfactory haematological response, whereas 33 patients (31.43%) were classified as non-responders, suggesting that relatively higher baseline iron parameters were associated with improved treatment response.

Table 5: Correlation and ROC Curve Analysis of Baseline Serum Ferritin and TSAT for Predicting Haematological Response

Table 5 presents the correlation and receiver operating characteristic (ROC) curve analysis of baseline serum ferritin and transferrin saturation for predicting haematological response. Serum ferritin demonstrated a positive correlation with haemoglobin improvement (r=0.370) and an AUC of 0.716 (95% CI: 0.606–0.813), indicating moderate discriminative ability. At an optimal cutoff of 12.17 ng/mL, serum ferritin showed 51.39% sensitivity and 87.88% specificity. Transferrin saturation demonstrated a stronger positive correlation (r=0.460), with an AUC of 0.731 (95% CI: 0.629–0.822). At a cutoff of 7.17%, TSAT provided 69.44% sensitivity and 66.67% specificity. The combined ferritin and TSAT model demonstrated the highest AUC of 0.757 (95% CI: 0.658–0.848), with 63.89% sensitivity and 81.82% specificity, suggesting improved discrimination when both parameters were considered together. All ROC analyses were statistically significant (p<0.001).

Table 6: Multivariable Logistic Regression Analysis of Predictors of Satisfactory Haematological Response to Oral Iron Therapy

Table 6 presents the multivariable logistic regression analysis identifying factors independently associated with satisfactory haematological response following oral iron therapy. Baseline transferrin saturation emerged as a statistically significant independent predictor, with an adjusted odds ratio (AOR) of 1.27 (95% CI: 1.07–1.52; p=0.007), indicating a 27% increase in the odds of satisfactory response for each one-percentage-point increase in baseline TSAT, after adjustment for other variables. Baseline

haemoglobin was also significantly associated with treatment response (AOR=2.09; 95% CI: 1.15–3.79; p=0.016). Although higher baseline serum ferritin was associated with increased odds of response (AOR=1.08; 95% CI: 0.96–1.22), this association was not statistically significant after adjustment (p=0.209). Increasing age demonstrated a nonsignificant negative association with treatment response (AOR=0.97; 95% CI: 0.93–1.01; p=0.096). These findings suggest that baseline TSAT and haemoglobin were independently associated with satisfactory haematological improvement following oral iron supplementation.

Table 1: Baseline Demographic and Clinical Characteristics of the Study Participants (N = 105)

Parameters	Number (n)	Percentage (%)
Age group (years)		
18–30	23	21.90
31–45	50	47.62
46–60	26	24.76
>60	6	5.71
Gender		
Male	40	38.10
Female	65	61.90
Dietary habits		
Vegetarian	54	51.43
Mixed diet	51	48.57
Clinical symptoms		
Fatigue	85	80.95
Pallor	80	76.19
Dizziness	33	31.43
Exertional dyspnoea	55	52.38
Palpitations	42	40.00
Anaemia severity		
Mild	3	2.86
Moderate	92	87.62
Severe	10	9.52

Table 2: Comparison of Baseline Clinical and Laboratory Parameters Between Responders and Non-Responders

Parameters	Responders (n = 72)	Non-responders (n = 33)	p-value
Age (years)	39.72 ± 12.37	43.06 ± 11.09	0.172
BMI (kg/m²)	22.95 ± 3.13	23.14 ± 3.10	0.773
Haemoglobin (g/dL)	9.27 ± 0.80	8.93 ± 0.85	0.058
MCV (fL)	73.11 ± 3.39	73.24 ± 3.46	0.855
MCH (pg)	23.28 ± 1.72	22.42 ± 1.57	0.014
RDW (%)	17.41 ± 1.36	17.28 ± 1.31	0.627
Serum ferritin (ng/mL)	13.00 ± 5.96	9.02 ± 4.38	<0.001
Transferrin saturation (%)	9.25 ± 3.82	6.21 ± 2.62	<0.001
Serum iron (µg/dL)	33.22 ± 13.78	22.01 ± 9.35	<0.001
TIBC (µg/dL)	359.12 ± 19.06	354.76 ± 16.50	0.236

Table 3: Changes in Haematological and Iron Profile Parameters Following Oral Iron Therapy (N = 105)

Parameters	Baseline	2 weeks	4 weeks	8 weeks	p-value
Haemoglobin (g/dL)	9.16 ± 0.83	9.85 ± 0.93	10.55 ± 1.06	11.31 ± 1.26	<0.001
MCV (fL)	73.15 ± 3.39	74.60 ± 3.41	76.72 ± 3.60	79.20 ± 4.04	<0.001
MCH (pg)	23.01 ± 1.72	23.48 ± 1.76	24.30 ± 1.89	25.35 ± 2.11	<0.001
RDW (%)	17.37 ± 1.34	17.91 ± 1.34	16.92 ± 1.34	15.87 ± 1.46	<0.001
Reticulocyte count (%)	0.81 ± 0.16	1.54 ± 0.35	1.15 ± 0.25	0.94 ± 0.19	<0.001
Serum ferritin (ng/mL)	11.75 ± 5.80	—	—	25.67 ± 9.17	<0.001
Transferrin saturation (%)	8.29 ± 3.76	—	—	17.56 ± 5.66	<0.001

Table 4: Association of Baseline Serum Ferritin and Transferrin Saturation with Haematological Response at 8 Weeks

Baseline parameters	Total (n)	Responders n (%)	Non-responders n (%)	p-value
Serum ferritin (ng/mL)				0.006
<10	48	26 (54.17)	22 (45.83)	
≥10	57	46 (80.70)	11 (19.30)	
TSAT (%)				0.002
<10	70	41 (58.57)	29 (41.43)	
≥10	35	31 (88.57)	4 (11.43)	
Overall treatment response	105	72 (68.57)	33 (31.43)	—

Table 5: Correlation and ROC Curve Analysis of Baseline Serum Ferritin and TSAT for Predicting Haematological Response

Predictive parameters	Spearman's r	AUC (95% CI)	Optimal cutoff	Sensitivity (%)	Specificity (%)	p-value (ROC)
Serum ferritin	0.370	0.716 (0.606–0.813)	12.17 ng/mL	51.39	87.88	<0.001
TSAT	0.460	0.731 (0.629–0.822)	7.17%	69.44	66.67	<0.001
Combined ferritin and TSAT	—	0.757 (0.658–0.848)	Predicted probability 0.714	63.89	81.82	<0.001

Table 6: Multivariable Logistic Regression Analysis of Predictors of Satisfactory Haematological Response to Oral Iron Therapy

Variables	Adjusted odds ratio (AOR)	95% confidence interval	p-value
Baseline serum ferritin (per ng/mL)	1.08	0.96–1.22	0.209
Baseline TSAT (per percentage point)	1.27	1.07–1.52	0.007
Age (per year)	0.97	0.93–1.01	0.096
Baseline haemoglobin (per g/dL)	2.09	1.15–3.79	0.016

DISCUSSION

The findings presented for the 105-patient study demonstrate the potential importance of baseline serum ferritin and transferrin saturation (TSAT) in predicting haematological response to oral iron supplementation among patients with iron deficiency anaemia (IDA). In the present study, females constituted 61.90% of participants, while 47.62% belonged to the 31–45 years age group. Moderate anaemia was observed in 87.62% of patients, with fatigue (80.95%) and pallor (76.19%) being the predominant clinical manifestations. Gaur et al. (2025), in a prospective study involving 190 patients with IDA at a tertiary care centre, reported a mean age of 32.34 ± 11.84 years, with females accounting for 90.50% of participants. Furthermore, 34.20% demonstrated abnormal oral iron absorption test results, while gastrointestinal malabsorption was identified in 19.50%. The findings of both studies highlight the considerable representation of younger adults and females among patients undergoing evaluation for iron deficiency. However, the higher female proportion in the study by Gaur et al. may reflect differences in the populations enrolled.[7] Fatigue was the most frequently observed clinical manifestation in the present study, affecting 80.95% of patients, followed by pallor (76.19%), exertional dyspnoea (52.38%), palpitations (40.00%), and dizziness (31.43%). These findings emphasize the symptomatic burden associated with iron deficiency and reduced haemoglobin concentrations. Vaucher et al. (2012), in a randomized controlled trial involving 198 non-anaemic menstruating women with serum ferritin below 50 µg/L and unexplained fatigue, evaluated the effect of oral iron supplementation over 12 weeks. The investigators reported a 47.70% reduction in fatigue scores among women receiving iron compared with a 28.80% reduction in the placebo group (p=0.02). Iron supplementation also produced significant improvements in haemoglobin (between-group difference 0.32 g/dL; p=0.002) and serum ferritin (11.40 µg/L; p<0.001). Although their participants did not have established anaemia, the findings support the clinical importance of iron deficiency in fatigue-related symptoms, which were highly prevalent in the present study.[8] The present study demonstrated progressive improvement in haemoglobin levels following oral iron supplementation, with mean haemoglobin increasing from 9.16 ± 0.83 g/dL at baseline to 9.85 ± 0.93 g/dL after two weeks, representing an increase of 0.69 g/dL. Reticulocyte count also increased from 0.81 ± 0.16% to 1.54 ± 0.35% during the same period, indicating an early erythropoietic response. Cacoub et al. (2025), in a prospective multicentre study involving 95 adults with moderate IDA, evaluated the early haematological response to oral ferrous gluconate supplementation. They reported that a haemoglobin increase of at least 0.50 g/dL could be detected within approximately 9–10 days, with an estimated mean increase of 0.51 g/dL by day 10 (95% CI: 0.45–0.57; p<0.0001). Serum iron also increased within the first three days, with a mean change of 67.21 ± 91.57 µg/dL. These findings are consistent with the early improvement observed in the present study, supporting the usefulness of short-interval haematological monitoring to identify initial treatment response.[9] Significant improvements were also observed in red blood cell indices and biochemical iron parameters during follow-up. Mean haemoglobin increased by 1.39 g/dL at four weeks and 2.15 g/dL at eight weeks, while MCV increased from 73.15 ± 3.39 to 79.20 ± 4.04 fL and MCH from 23.01 ± 1.72 to 25.35 ± 2.11 pg. Serum ferritin improved from 11.75 ± 5.80 to 25.67 ± 9.17 ng/mL, while TSAT increased from 8.29 ± 3.76% to 17.56 ± 5.66% after eight weeks. Dhanush et al. (2025), in a randomized controlled trial involving 68 women with IDA, compared daily oral iron supplementation with alternate-day administration. At 28 days, haemoglobin increased by 1.30 ± 1.10 g/dL in the daily group compared with 2.20 ± 1.30 g/dL in the alternate-day group (p=0.003). Median serum ferritin

increased from 6.50 to 16.00 µg/L in the daily group and from 5.10 to 20.30 µg/L in the alternate-day group. Median TSAT also improved from 5% to 10% and from 4% to 13%, respectively. These observations support the improvements in haemoglobin and iron availability demonstrated in the present study, although treatment schedules differed.[10] The magnitude of haemoglobin improvement following oral iron therapy was another important finding of the present study. Mean haemoglobin increased from 9.16 ± 0.83 g/dL at baseline to 11.31 ± 1.26 g/dL after eight weeks, representing an overall improvement of 2.15 g/dL ($p<0.001$). Pasupathy et al. (2023), in a randomized controlled trial involving 200 adults with IDA, compared daily administration of 60 mg elemental iron with 120 mg elemental iron administered on alternate days. Baseline haemoglobin concentrations were 6.68 ± 1.89 g/dL and 6.53 ± 1.89 g/dL in the daily and alternate-day groups, respectively. After eight weeks, mean haemoglobin increased by 1.36 ± 1.51 g/dL in the daily group and 1.05 ± 1.34 g/dL in the alternate-day group, without a statistically significant difference between treatments ($p=0.47$). The greater mean haemoglobin improvement observed in the present study may be related to differences in baseline anaemia severity, patient characteristics, iron absorption, and treatment adherence. Nevertheless, both studies demonstrated clinically relevant improvement following oral iron supplementation.[11]

In the present study, 72 patients (68.57%) achieved satisfactory haematological response after eight weeks, whereas 33 patients (31.43%) were classified as non-responders. Patients with baseline serum ferritin ≥10 ng/mL demonstrated a significantly higher response rate than those with ferritin below 10 ng/mL (80.70% versus 54.17%; $p=0.006$). Similarly, patients with baseline TSAT ≥10% had a higher response rate than those with TSAT below 10% (88.57% versus 58.57%; $p=0.002$). Kaundal et al. (2020), in a randomized controlled trial involving 62 patients with IDA, compared twice-daily administration of 60 mg elemental iron with 120 mg administered on alternate days. A haemoglobin increase of at least 2 g/dL was achieved in 32.30% versus 6.50% of participants at three weeks ($p<0.0001$) and 58.00% versus 35.50% at six weeks ($p=0.001$), respectively. Although the present study demonstrated a higher overall response rate, direct comparisons are limited by differences in treatment duration, dosing frequency, and response criteria. These results collectively suggest that haematological improvement depends on both baseline iron status and treatment-related factors.[12]

The predictive importance of treatment response was further supported by the correlation and ROC curve findings of the present study. Baseline serum ferritin demonstrated a positive correlation with haemoglobin improvement ($r=0.370$), while TSAT showed a stronger correlation ($r=0.460$). Serum ferritin demonstrated an AUC of 0.716, with sensitivity of 51.39% and specificity of 87.88% at a cutoff of 12.17 ng/mL. TSAT demonstrated an AUC of 0.731, with sensitivity of 69.44% and specificity of 66.67% at a cutoff of 7.17%. Okam et al. (2017), in an analysis of five clinical trials involving patients receiving oral iron therapy, reported that 72.80% achieved an early haemoglobin response, defined as an increase of at least 1 g/dL by day 14. This early response predicted subsequent satisfactory improvement with 90.10% sensitivity and 79.30% specificity. Although the study by Okam et al. evaluated early haemoglobin change rather than baseline ferritin or TSAT, its findings demonstrate the clinical importance of identifying patients likely to respond adequately to oral iron therapy.[13] The present study demonstrated that baseline ferritin and TSAT possessed moderate predictive ability, with AUC values of 0.716 and 0.731, respectively. Combining both parameters improved the AUC to 0.757 (95% CI: 0.658–0.848), with sensitivity of 63.89% and specificity of 81.82%. Pei et al. (2023), using data from a randomized controlled trial involving 356 Cambodian women receiving 60 mg elemental iron daily for 12 weeks, investigated reticulocyte haemoglobin equivalent (RET-He) as a predictor of haematological response. They reported an AUC of 0.70 (95% CI: 0.63–0.76) for baseline RET-He and 0.48 (95% CI: 0.41–0.56) for RET-He measured after one week. However, the change in RET-He from baseline to one week demonstrated a substantially higher AUC of 0.81 (95% CI: 0.75–0.87). These findings suggest that dynamic changes in erythropoietic biomarkers may provide additional predictive information beyond baseline measurements. The present findings similarly indicate that combined assessment of iron parameters may improve discrimination, although further validation is required before applying the proposed cutoff values clinically.[14]

Multivariable logistic regression analysis in the present study demonstrated that baseline TSAT was independently associated with satisfactory haematological response (AOR=1.27; 95% CI: 1.07–1.52; $p=0.007$). Baseline haemoglobin was also a significant independent predictor (AOR=2.09; 95% CI: 1.15–3.79; $p=0.016$). Although serum ferritin showed a positive association with treatment response, its adjusted association was not statistically significant (AOR=1.08; $p=0.209$). Pei et al. (2021), in an analysis of iron supplementation among 407 Cambodian women, evaluated baseline haematological biomarkers as predictors of haemoglobin response after 12 weeks. Among 383 participants completing the trial, 95 (24.80%) achieved a haemoglobin increase of at least 1 g/dL. Baseline haemoglobin and inflammation-adjusted ferritin demonstrated AUC values of 0.81 and 0.83, respectively, while a combined model incorporating haemoglobin, ferritin, and hepcidin achieved an AUC of 0.86. In comparison, the combined ferritin–TSAT model in the present study achieved an AUC of 0.757. These findings reinforce the importance of

baseline haematological and iron-related parameters in predicting oral iron responsiveness, while suggesting that the contribution of individual biomarkers may differ according to population characteristics and the predictive model employed.[15]

CONCLUSION

The present study demonstrated that baseline serum ferritin and transferrin saturation (TSAT) were associated with haematological response to oral iron therapy in patients with iron deficiency anaemia. A satisfactory haematological response was observed in 68.57% of patients, with significant improvements in haemoglobin levels and iron profile parameters after eight weeks of treatment. Baseline TSAT and haemoglobin emerged as significant independent predictors of treatment response, while the combined assessment of serum ferritin and TSAT demonstrated improved predictive performance. These findings suggest that baseline iron parameters may be useful for predicting therapeutic response, guiding individualized treatment strategies, and identifying patients requiring closer monitoring.

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