

Iron Deficiency without Anemia: Diagnostic Challenge and the Role of Lifestyle and Dietary Intervention

Lakshmi Gayathri M^{1,*}, Saumya¹, Munagala Poornima Aiswarya², B Raga Sudha³, Sai Harini⁴

¹Department of Pharmacy Practice, KLE College of Pharmacy, Bengaluru, Constituent unit of KLE Academy of Higher Education and Research (Deemed to be University), Bengaluru, Karnataka, INDIA.

²Vascular Surgery Registrar, James Cook University Hospital, South Tees NHS Foundation Trust, Middlesbrough, UNITED KINGDOM.

³Civil Assistant Surgeon, PHC Narayanavanam, Narayanavanam Mandal, Tirupati, Andhra Pradesh, INDIA.

⁴Civil Assistant Surgeon, Tirupati, Andhra Pradesh, INDIA.

ABSTRACT

Iron Deficiency without Anaemia (IDWA) or Non-Anaemic Iron Deficiency (NAID) is frequently overlooked, especially in women from developing nations. This condition is characterized by low serum ferritin levels and low transferrin saturation levels, accompanied by normal haemoglobin counts. Early diagnosis and treatment are important in avoiding the development of iron deficiency anaemia and its associated systemic effects. A 28-year-old female came to the dermatology clinic with complaints of sudden skin pigmentation, diffuse hair loss, generalized weakness, dizziness, and depressive symptoms for the last three months. She reported having very poor dietary habits, with a minimal intake of iron-rich foods for nearly four years. The full blood count was within normal limits (e.g., haemoglobin 13.2 g/dL). However, key findings included low serum ferritin (19.5 ng/mL), low serum iron (35.6 mg/dL), elevated TIBC (503.8 µg/dL), and low transferrin saturation (11.50%). The diagnosis of Iron Deficiency without Anaemia was confirmed by a peripheral smear showing a normocytic normochromic picture. The patient initially received ferrous sulphate but was switched to ferrous fumarate due to constipation, leading to better tolerability. She also received advice regarding improved dietary habits. After one year of sustained therapy and dietary changes, follow-up testing showed normalization of iron studies, including serum ferritin (33.3 ng/mL) and transferrin saturation (20.76%). The patient reported significant improvement in symptoms, including fatigue, hair loss, and mood. This case underscores the need to recognize iron deficiency without anaemia as a distinct clinical syndrome that may present with dermatological and neuropsychiatric complaints despite normal haemoglobin levels. Early recognition through targeted laboratory evaluation and appropriate therapy is essential to improve patient outcomes. Switching from ferrous sulphate to ferrous fumarate demonstrated improved compliance due to better gastrointestinal tolerability.

Keywords: Dietary intervention, Ferrous fumarate, Iron deficiency without anemia, Iron studies, Lifestyle modification.

Correspondence:

Dr. Lakshmi Gayathri M

Assistant Professor, Department of Pharmacy Practice, KLE College of Pharmacy, Bengaluru, Constituent unit of KLE Academy of Higher Education and Research (Deemed to be University), Bangalore-560010, Karnataka, INDIA.
Email: lakshmigayathri40@gmail.com

Received: 15-05-2026;

Revised: 21-07-2026;

Accepted: 08-09-2026.

INTRODUCTION

In the field of medical science, Iron Deficiency without Anemia (IDWA) is a separate yet frequently unrecognized problem of importance. Iron deficiency is the most widespread nutritional deficiency in the world, most prevalent in women and children of developing countries. Detection of iron deficiency without anemia is, however, comparatively less well established than Iron Deficiency Anemia (IDA) due to the lack of standardized diagnostic criteria (Clénin, 2017). Around one-fifth of the entire population is affected by iron deficiency anemia, a syndrome of

iron deficiency causing decreased haemoglobin levels (Balendran and Forsyth, 2021).

IDWA is characterized by low iron levels (e.g., serum ferritin, transferrin saturation, TIBC, UIBC) without anemia (Munder *et al.*, 2020). Iron deficiency without anemia was found to be surprisingly common, affecting more than half of women (around 57.5%) compared to only about 7.6% of men. IDWA occurs at a frequency three times lower than IDA, with patients often exhibiting symptoms despite normal laboratory findings, indicative of a latent or prelatent phase (Soppi, 2018). The obscured nature of IDWA may lead to misdiagnosis or inadequate screening protocols (Al-Naseem *et al.*, 2021).

Latent iron deficiency represents an early stage of iron depletion where body iron stores are reduced, indicated by low serum ferritin and transferrin saturation, yet hemoglobin levels remain within normal limits. This phase is often asymptomatic or presents with



DOI: 10.5530/ijpi.20270163

Copyright Information :

Copyright Author (s) 2027 Distributed under
Creative Commons CC-BY 4.0

Publishing Partner : Manuscript Technomedia, [www.mstechnomedia.com]

nonspecific symptoms such as fatigue and poor concentration. In contrast, overt iron deficiency, or Iron Deficiency Anemia (IDA), involves both depleted iron stores and reduced hemoglobin levels, leading to more pronounced symptoms including pallor, dyspnea, and reduced exercise tolerance. Distinguishing between these stages is crucial for timely intervention and prevention of anemia progression. It merits attention that iron assays yield inferior outcomes in IDWA, even in the absence of anemia (where all Complete Blood Count parameters remain within normal limits) (Al-Jafar, 2017).

Iron serves as a ubiquitous element within cellular structures, playing a pivotal role in diverse physiological processes such as haemoglobin synthesis, intracellular electron transport mediation, and enzymatic activities across multiple tissues (Ogun and Adeyinka, 2022). A substantial portion of ferritin, around 75%, is requisite for haemoglobin biosynthesis, while the remaining fraction, roughly 10 to 20%, exists in a readily accessible state within the bloodstream. This freely circulating ferritin engages with transferrin receptors, facilitating its incorporation into the bloodstream, with the process regulated by hepatic transferrin production and ferroportin-mediated iron release. The peptide hormone hepcidin serves as a critical regulator of iron homeostasis, modulating serum ferritin levels by inhibiting ferroportin activity, thereby impeding ferritin release into the bloodstream (Collins *et al.*, 2008).

Researchers aim to improve the understanding of early IDWA identification and alleviation to prevent minor clinical issues. This objective can be advanced through heightened public awareness concerning the potential misclassification of IDWA symptoms as commonplace menstrual occurrences, with subtle indicators such as mood fluctuations and lethargy often overlooked. Notably, this investigation scrutinizes the correlation between diminished ferritin levels among middle-aged women and the rigors of their hectic and stress-laden lifestyles.

This report aims to highlight the diagnostic challenges and therapeutic management of Iron Deficiency without Anemia (IDWA) in a young female, emphasizing the importance of early recognition and intervention to prevent progression to anemia.

Patient Information

A 28-year-old female patient (height: 163 cm, weight: 48 kg) presented with chief complaints of weakness, intermittent episodes of dizziness, abrupt pigmentation, hair fall, and depression in the Dermatology OPD. The patient had no history of alcohol or tobacco consumption. The patient, however, had a medical history of seizures and depression (six years ago). She was prescribed 500 mg of sodium valproate, 300 mg of oxcarbazepine, 2 mg of lorazepam, and 10 mg of escitalopram for her condition. She was on the above treatment for four years and which was later tapered down and discontinued. The patient also had a history of hypotension in childhood.

Her dietary history included mostly food from restaurants and takeaways for four years, depriving her of a balanced diet, including vitamins and minerals. The patient's menstrual history was normal. She had no family history of anemia or metabolic disorders.

Clinical Findings

On clinical examination, the patient appeared mildly pale, with diffuse hair thinning and patchy facial pigmentation. Vital signs were stable, and systemic examination revealed no abnormalities. The patient's symptoms included generalized fatigue, reduced concentration, and occasional dizziness.

Timeline

- **June 2023:** Initial presentation with weakness, dizziness, pigmentation, and hair fall. Laboratory results showed low ferritin, TIBC, UIBC, Vitamin B₁₂, and Vitamin D, but normal CBC. Diagnosed with IDWA and started on ferrous sulphate (200 mg daily), Vitamin D₃ (60,000 IU weekly for 8 weeks), and Vitamin B₁₂ injections (1000 µg).
- **January 2024 (6-month follow-up):** Improved iron indices, normalized Vitamin B₁₂ and calcium. Ferrous sulphate discontinued due to constipation; switched to ferrous fumarate (300 mg daily).
- **June 2024 (12-month follow-up):** Complete normalization of iron studies and CBC parameters. Marked clinical improvement and resolution of symptoms.

Diagnostic Focus And Assessment

Following a thorough clinical evaluation, the patient was advised to undergo a set of laboratory tests. Table 1 denotes the laboratory tests that the patient underwent as advised by the doctor. Among the tests, Complete Blood Count was normal, whereas the Iron studies, along with Vitamin B₁₂ and D, were reduced. Based on these findings, the provisional diagnosis for the patient suggests Iron Deficiency.

The differential diagnosis involved several tests, including an assessment of iron studies. Additional differential diagnoses, including hypothyroidism, chronic infections, and autoimmune disorders, were considered due to overlapping symptoms such as fatigue and hair loss. The thyroid function tests (TSH, T₃, T₄) were within normal ranges, ruling out thyroid dysfunction. The patient also had a normal blood glucose level and insulin resistance. There were no clinical signs or laboratory markers indicative of chronic inflammation or infection, and autoimmune screenings were unremarkable. However, the presence of pigmentation was marked by a significant decrease in Vitamin B₁₂ levels. This assessment included observing the levels of Serum Ferritin (<30 ng/mL), TIBC, and UIBC in June 2023, January 2024, and June 2024. The Peripheral Smear Test was normal. Table 2 illustrates

the various changes in trends and timelines in the iron studies. The key findings that led to the diagnosis were:

- Low serum ferritin (<30 ng/mL).
- Reduced transferrin saturation and UIBC.
- Normal hemoglobin and hematocrit.
- Low Vitamin B₁₂ and Vitamin D.

Following the observation of all laboratory investigations, the patient was diagnosed with confirmed Iron Deficiency without Anemia.

Therapeutic Intervention

Following confirmation of the test results, the patient was prescribed Injection Vitamin B₁₂ 1000 mg and Capsule Vitamin D₃ 60K once per week for 8 weeks. In addition, the patient was prescribed ferrous sulphate (Fersolate) tablets 200 mg once daily for three months in concern of reduced iron studies. The severity of the illness and the advantages of taking the supplement were discussed with the patient. Patient counselling was provided to the patient regarding diet and lifestyle. The patient was advised to consume foods high in iron, such as pomegranate juice, and leafy

greens like spinach and kale; lentils, beans. The patient was also advised to include Vitamin-C-rich foods like strawberries and citrus fruits like oranges and lemon, and to avoid tea and coffee as they reduce iron absorption. Regarding lifestyle, the patient was advised to avoid intense physical activity. Mild workout, like slow walking, yoga, was recommended along with regular medical check-ups.

Follow-Up and Outcomes

The patient underwent follow-up after six months (January 2024), reporting that the Vitamin B₁₂ and Calcium levels recovered to normal, with an improvement in the iron studies. The Complete Blood Count results were also within normal limits. Due to a concern for constipation, the patient did not comply with the initial prescription of ferrous sulphate (Fersolate tablets). The patient's concern about constipation was addressed by replacing the ferrous sulphate (Fersolate) tablet with a combination ferrous fumarate (Zincofer) tablet, 300 mg, taken once daily, which has a lower incidence of causing constipation, better tolerability, due to presence of Vitamin C which increases absorption of iron and hence, improved patient compliance. The patient continued with the previous lifestyle and diet as discussed during the last visit. A 12-month follow-up in June 2024 revealed that all

Table 1: This table depicts abnormal values in the Iron studies and Complete blood count in June 2023, January 2024 and June 2024.

Test Name	Lab Values in June 2023	Lab Values in January 2024	Lab Values in June 2024	Normal Lab Values
Complete Blood Count				
Haemoglobin	13.2 g/dL	13.7g/dL	13.9g/dL	12-15g/dL
Haematocrit	36.1%	38.4%	40%	36%-46%
MCV	83.2 fL	84.9 fL	85.2 fL	83-101 fL
MCH	27.5 pg	27.9pg	28.1pg	27-32pg
Iron Studies				
Serum Iron	35.6 µg/dL	48.4 µg/dL	53 µg/dL	60 - 180 µg/dL
Ferritin	19.5 ng/mL	28.3 ng/mL	33.3 ng/mL	30-306.8 ng/mL
UIBC	397.80 µg/dL	341.50 µg/dL	345.50 µg/dL	155-355 µg/dL
TIBC	503.8 µg/dL	412 µg/dL	397.59 µg/dL	250 - 400 µg/dL
Transferrin Saturation	11.50%	18.39%	20.76%	15-50%
Vitamin B ₁₂	103 pg/mL	415 pg/mL	502 pg/mL	180 - 914 pg/mL
Vitamin D	13.62 ng/mL	ng/mL	32.2 ng/mL	30- 100 ng/mL
Thyroid Profile				
TSH	2.3 µIU/mL	2.1 µIU/mL	2.0 µIU/mL	0.4 - 4.2 µIU/mL
Free T3	pg/mL	3.2 pg/mL	3.3 pg/mL	2.0 - 4.4 pg/mL
Free T4	ng/dL	1.3 ng/dL	1.3 ng/dL	0.8 - 1.8 ng/dL
Glucose & Insulin				
Fasting Blood Glucose	87 mg/dL	89 mg/dL	90 mg/dL	70 - 100 mg/dL
Fasting Insulin	6 µIU/mL	7 µIU/mL	6 µIU/mL	2 - 20 µIU/mL
HOMA-IR	1.3	1.5	1.3	< 2.5 (Normal, no insulin resistance)

lab investigations were within normal ranges, and the patient's health had improved both symptomatically and holistically. The patient reported that identifying the cause of her unexplained fatigue brought relief and increased her confidence in medical interventions.

DISCUSSION

Iron Deficiency without Anemia (IDWA) can present with a wide variety of extra-hematological signs and symptoms, particularly dermatological (e.g., hair loss, hyperpigmentation, dry skin) and neuropsychiatric symptoms (e.g., chronic fatigue, poor concentration, irritability, depressive mood) even in individuals with normal hemoglobin. Since these signs and symptoms are nonspecific in nature, many patients do not receive an appropriate diagnosis and treatment for their IDWA, as physicians may easily overlook them or default to an explanation of stress or lifestyle factors. The key to a diagnosis of IDWA lies in the assessment of serum ferritin and transferrin saturation, as these represent the body's true iron stores and transport mechanisms, respectively. A decrease in ferritin suggests low stores of iron in the body, whereas a low transferrin saturation suggests dysfunctional iron availability for cellular functions, despite normal red cell indices.

Finally, a majority of the desired outcome in managing a patient will be dependent largely on compliance with treatment. Although oral ferrous sulphate is universally used, it can be one of the more poorly tolerated formulations because of its many gastrointestinal side effects (e.g., constipation, nausea, abdominal discomfort), leading to issues with compliance. A clinical study suggested that while ferrous fumarate has the same efficacy, it showed improvements from a tolerability standpoint, and thus resulted in improved compliance and significantly improved clinical outcomes.

Additionally, early and individualized nutritional counselling is an important component of IDWA management. It is imperative to educate the patient about how to include iron-rich foods like green leafy vegetables, legumes, pomegranates, and lean meats, as well as Vitamin C-rich substances that may improve absorption, and avoid tea and coffee and other inhibitors of iron absorption, which dramatically improves the effectiveness of treatment. Finally, an integrated approach that couples medical treatment with nutrition and lifestyle changes not only restores iron balance but will also lead to sustained improvements in health, well-being, and quality of life.

Hassan A. Al-Jafar undertook a retrospective investigation encompassing 6993 patients afflicted with hypoferritinemia, sourced from a database spanning the years 2010 to 2016. The study scrutinized several parameters, including mean corpuscular haemoglobin, red blood cell count, haemoglobin concentration, haematocrit level, and serum ferritin concentration, in order to delineate the presence of Iron Deficiency Without Anaemia (IDWA). Among the hypoferritinemia cohort, 130 individuals (constituting 0.018%) were identified as presenting with IDWA, with a female-to-male ratio ranging from 1.7 to 1 (Al-Jafar, 2017).

Concurrently, Munder Abuaisha *et al.*, conducted a single-centre, retrospective inquiry at the American University of Beirut Medical Centre (AUBMC), focusing on patients attending family medicine clinics between June 2010 and March 2018. Their study comprised 1784 subjects aged between 18 and 50 years. The investigation revealed a prevalence rate of IDWA at 57.5% (with a confidence interval of 55.08% to 59.92%) among women and 7.6% (with a confidence interval of 3.77% to 11.43%) among men. Notably, IDWA manifested in 14% of women and 0.5% of men throughout the five-year follow-up. These findings underscore the continued prevalence of IDWA among women of reproductive age, with only a fraction of them progressing to anemia within the stipulated five-year period (Collins *et al.*, 2008).

Table 2: This Table shows the timeline of events for the patient that followed in our case.

Timepoint	Iron Studies / Related Labs	CBC Status	Clinical Status / Interventions
Initial Presentation (June 2023)	↓ Serum Ferritin, ↓ TIBC, ↓ UIBC, ↓ Vitamin B12, ↓ Vitamin D	Normal CBC	Patient presented with weakness, dizziness, hair fall, pigmentation, and depression. Diagnosed with IDWA. Prescribed ferrous sulfate, Vitamin B ₁₂ injection, Vitamin D ₃ . Counselling on diet and lifestyle changes.
Follow-Up (6 months post-treatment: January 2024)	Improved iron studies, normal Vitamin B ₁₂ and calcium	Normal CBC	Symptomatic improvement. Ferrous sulfate discontinued due to constipation. Switched to ferrous fumarate (Zincofer). Continued dietary changes and supplements.
Follow-Up (12 months post-treatment: June 2024)	Iron studies normalized	Normal CBC	Full clinical recovery. No recurrence of symptoms. Patient reported improved quality of life and treatment. Continued lifestyle and dietary adherence.

The literature supports the notion that IDWA can lead to similar symptoms as IDA, including cognitive impairment and fatigue. The studies highlight that many patients with IDWA experience debilitating symptoms that can severely impact their quality of life, reinforcing the need for heightened awareness among healthcare providers. The literature similarly points out that conventional iron studies may not adequately reflect iron deficiency in patients without anemia. This has led to calls for improved diagnostic criteria and screening methods to identify IDWA effectively. The literature also advocates for a multifaceted approach to managing IDWA, incorporating both pharmacological and dietary strategies. The change of Fersolate tablets (Ferrous Sulphate) to Zincofer (Ferrous fumarate) indicates that even side effects play a pivotal role in patient care and treatment. It emphasizes the importance of educating patients about iron-rich foods and lifestyle modifications to enhance iron absorption and overall health.

Our case report investigates the silent struggle in a 28-year-old female associated with Iron Deficiency without Anemia. The study reveals the complex interplay of dietary and lifestyle factors affecting young women. Few studies have specifically examined IDWA in depth. A customized intervention consisting of both pharmacological and non-pharmacological treatments was provided. The patient complied with the prescription by switching from a ferrous sulphate (Fersolate tablet) to a Zincofer tablet (combination iron fumarate supplement) as part of the pharmacological intervention due to better tolerability. The non-pharmacological intervention consisted of lifestyle and nutrition counselling. Increasing the selection of iron-rich foods and creating a diet plan promoting higher bioavailability are the key adjustments that lead to improvement and maintenance in the patient's iron status through diet (Aspuru *et al.*, 2011). The patient was counselled on the dietary alternatives, which include the intake of nuts, legumes, fruits like pomegranates and oranges, green leafy vegetables like spinach, kale, and animal products like chicken, egg, and fish.

PATIENT PERSPECTIVE

The patient expressed relief upon receiving a definitive diagnosis for her persistent fatigue and hair loss. She reported improved confidence in medical interventions and expressed satisfaction with the treatment outcomes. The dietary and lifestyle modifications were well accepted, and the switch to ferrous fumarate significantly enhanced her treatment adherence (Gill, 2023).

CONCLUSION

Iron Deficiency without Anemia (IDWA) is a frequently overlooked clinical syndrome that can manifest through diverse extra-hematological symptoms, including dermatological and neuropsychiatric complaints, despite normal hemoglobin

levels. This case highlights that recognizing low serum ferritin and transferrin saturation is paramount for timely diagnosis. Successful management requires an integrated approach, coupling pharmacological intervention (e.g., switching from ferrous sulphate to better-tolerated ferrous fumarate to ensure compliance) with essential dietary and lifestyle modifications. Heightened awareness among healthcare providers is necessary to prevent progression to anemia and significantly improve patients' quality of life.

ACKNOWLEDGEMENT

The authors would like to thank all faculty members and the management of the KLE College of Pharmacy, Bangalore-560010, for providing all necessary technical support and motivating us at every stage.

ABBREVIATIONS

IDWA: Iron Deficiency without Anemia; **IDA:** Iron Deficiency Anemia; **CBC:** Complete Blood Count; **MCV:** Mean Corpuscular Volume; **MCH:** Mean Cell Haemoglobin; **UIBC:** Unsaturated Iron-Binding Capacity; **TIBC:** Total Iron-Binding Capacity; **TSH:** Thyroid Stimulating Hormone; **T₃:** Triiodothyronine; **T₄:** Thyroxine; **KLE:** KLE Academy of Higher Education and Research; **OPD:** Outpatient Department; **PHC:** Primary Health Centre; **AUBMC:** American University of Beirut Medical Centre.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHOR CONTRIBUTIONS

Saumya Sharma: Contributed to concept development, data acquisition, manuscript drafting, and literature review. **Lakshmi Gayathri M:** Involved in concept development, patient management, and critical review of the manuscript. **Munagala Poornima Aiswarya:** Assisted in data acquisition, analysis, and manuscript drafting. **B. RagaSudha:** Provided overall guidance in concept development, supervised patient management, and performed the final critical review of the manuscript. **Dr. Sai Harini:** Contributed to the final review of the manuscript.

INFORMED CONSENT

Written informed consent was obtained from the patient for publication of this case report and any accompany.

REFERENCES

- Al-Jafar, H. A. (2017). HWA: Hypoferritinemia without anemia - A hidden hematology disorder. *Journal of Family Medicine and Primary Care*, 6(1), 69-72.
- Al-Naseem, A., Sallam, A., Choudhury, S., & Thachil, J. (2021). Iron deficiency without anemia: A diagnosis that matters. *Clinical Medicine (London)*, 21(2), 107-113. <https://doi.org/10.7861/clinmed.2021-0003>
- Aspuru, K., Villa, C., Bermejo, F., Herrero, P., & López, S. G. (2011). Optimal management of iron deficiency anemia due to poor dietary intake. *International Journal of General Medicine*, 4, 741-750. <https://doi.org/10.2147/IJGM.S18018>

- Balendran, S., & Forsyth, C. (2021). Non-anaemic iron deficiency. *Australian Prescriber*, 44(6), 193-196. <https://doi.org/10.18773/austprescr.2021.052>
- Clénin, G. E. (2017). The treatment of iron deficiency without anemia (in otherwise healthy persons). *Swiss Medical Weekly*, 147(2324), Article w14434. <https://doi.org/10.4414/smww.2017.14434>
- Collins, J. F., Wessling-Resnick, M., & Knutson, M. D. (2008). Hepcidin regulation of iron transport. *Journal of Nutrition*, 138(11), 2284-2288. <https://doi.org/10.3945/jn.108.096347>
- Gill, M. B. (2023, August 10). Ferrous sulfate vs fumarate. Power. <https://www.withpower.com/guides/ferrous-sulfate-vs-fumarate-e4de>
- Munder Abu Aisha, R., El Masri, R., Itani, H., & Antoun, J. (2020). Prevalence of Iron Deficiency (ID) without anemia in the general population presenting to primary care clinics: A cross-sectional study. *Postgraduate Medicine*, 132(3), 1-7. <https://doi.org/10.1080/00325481.2020.1715701>
- Ogun, A. S., & Adeyinka, A. (2022). Biochemistry, transferrin. In *StatPearls* [Internet]. StatPearls Publishing. <https://www.ncbi.nlm.nih.gov/books/NBK532928/>
- Soppi, E. T. (2018). Iron deficiency without anemia - A clinical challenge. *Clinical Case Reports*, 6(6), 1082-1086. <https://doi.org/10.1002/ccr3.1529>

Cite this article: Gayathri ML, Saumya, Aiswarya MP, Sudha BR. Iron Deficiency without Anemia: Diagnostic Challenge and the Role of Lifestyle and Dietary Intervention. *Int. J. Pharm. Investigation*. 2027;17(1):498-503.