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Study of Clinico-Demographic Profile of Iron Deficiency Anemia Patients Attending Admitted in Tertiary Care Hospital in Upper Assam

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Abstract: ***Background**: Iron deficiency anemia (IDA) is the most common nutritional deficiency worldwide and remains a major public health concern, particularly in developing regions. It affects individuals across all age groups and is associated with significant morbidity due to impaired oxygen delivery, reduced work capacity, and adverse clinical outcomes. Understanding the clinico-demographic profile of patients with IDA is essential for identifying high-risk groups and implementing effective prevention and management strategies. **Objective**: To evaluate the clinico-demographic characteristics, clinical presentation, etiological factors, and laboratory parameters of patients with iron deficiency anemia admitted to a tertiary care hospital in Upper Assam. **Methods**: A hospital-based observational study was conducted over a period of 12 months among 62 patients aged ≥13 years with laboratory-confirmed IDA. Data on demographic variables, dietary habits, clinical features, and etiological factors were collected using a structured proforma. Laboratory investigations included hemoglobin, red cell indices, serum ferritin, serum iron, and total iron-binding capacity. Statistical analysis was performed using SPSS, with a p-value <0.05 considered significant. **Results**: Severe anemia was more prevalent (45/62) compared to moderate anemia (17/62). Higher proportions of severe anemia were observed in older age groups (>60 years: 87.5%) and males (85.2%), though associations were not statistically significant (p>0.05). Illiterate patients showed 100% severe anemia. Fatigue (65.9%) was the most common symptom, while combined pallor and palpitations were associated with higher severity (88.9%). Nutritional deficiency (21 cases) was the most common etiology. Among laboratory parameters, mean corpuscular hemoglobin concentration (MCHC) was significantly lower in severe anemia (26.88 ± 4.21) compared to moderate anemia (29.52 ± 3.21) (p=0.023). **Conclusion**: Severe anemia was highly prevalent and influenced by multiple demographic and clinical factors. Early detection, improved nutritional awareness, and targeted interventions are essential to reduce disease burden and prevent progression to severe anemia.*

Keywords: Clinico-demographic profile, Iron deficiency anemia, Nutritional deficiency, Severity, Tertiary care hospital

1. Introduction

Iron deficiency anemia (IDA) is recognized as the most prevalent nutritional deficiency disorder worldwide, affecting approximately 1.62 billion people and accounting for nearly one-fourth of the global population, thereby representing a major public health challenge, particularly in low- and middle-income countries [1]. It arises when iron availability is insufficient to meet the demands of hemoglobin synthesis, leading to reduced oxygen-carrying capacity of blood and subsequent tissue hypoxia. The burden of IDA is disproportionately higher in developing regions due to poor dietary intake, limited bioavailability of iron, recurrent infections, parasitic infestations, chronic blood loss, and inadequate healthcare access [2]. In India, despite multiple national programs aimed at anemia control, the prevalence remains high, especially among vulnerable groups such as children, adolescent girls, and women of reproductive age, reflecting the multifactorial and persistent nature of the problem. Iron plays a crucial role not only in hemoglobin formation but also in cellular metabolism, immune function, and cognitive development; hence, deficiency results in wide-ranging systemic consequences including fatigue, impaired physical performance, reduced work productivity, and compromised neurocognitive development [3].

The etiology of IDA is complex and varies across populations, encompassing nutritional deficiency, chronic blood loss, malabsorption syndromes, and increased physiological requirements. Dietary insufficiency remains a primary contributor, particularly in populations consuming predominantly plant-based diets with low iron bioavailability, further exacerbated by dietary inhibitors such as phytates and tannins [4]. Chronic blood loss, especially from the gastrointestinal tract and heavy menstrual bleeding in women, represents another major cause, often requiring detailed clinical evaluation to identify underlying pathology. Parasitic infections such as hookworm and conditions like Helicobacter pylori infection have also been implicated in the pathogenesis of IDA by causing iron loss or impairing absorption [5]. Additionally, malabsorption disorders like celiac disease contribute to refractory cases of IDA, highlighting the need for comprehensive etiological assessment. Physiological states such as pregnancy, adolescence, and rapid growth phases further increase iron requirements, predisposing individuals to deficiency when intake is inadequate.

Clinically, IDA presents with a spectrum ranging from asymptomatic cases to severe anemia characterized by pallor, fatigue, dyspnea, palpitations, and reduced exercise tolerance. Non-specific symptoms often delay diagnosis, allowing the condition to progress and increasing the risk of complications [6]. In children, iron deficiency can lead to irreversible cognitive impairment and developmental delays, while in adults it significantly reduces productivity and quality of life. Maternal iron deficiency is associated with adverse pregnancy outcomes including preterm birth, low birth weight, and increased maternal morbidity and mortality, thereby affecting both maternal and neonatal health outcomes [7]. Laboratory investigations such as complete blood count, serum ferritin, serum iron, total iron-binding capacity, and transferrin saturation are essential for accurate diagnosis and differentiation from other types of anemia [8].

Understanding the clinico-demographic profile of patients with IDA is critical for identifying high-risk groups and tailoring effective intervention strategies. Regional variations

in dietary habits, socioeconomic status, healthcare accessibility, and environmental exposures significantly influence the prevalence and causes of IDA, necessitating localized studies to generate context-specific evidence [9]. Hospital-based observational studies provide valuable insights into patient characteristics, clinical presentation, and underlying etiologies, thereby aiding clinicians in early diagnosis and appropriate management. Such data are also instrumental in guiding public health policies, optimizing resource allocation, and designing targeted screening and prevention programs. Furthermore, studying clinico-demographic patterns helps in identifying emerging trends in disease causation, such as the increasing contribution of chronic diseases and gastrointestinal pathologies in adult populations [10].

The present study aims to evaluate the clinico-demographic profile of iron deficiency anemia patients admitted to a tertiary care hospital in Upper Assam, providing region-specific data on age distribution, gender differences, socioeconomic factors, clinical features, and etiological determinants. This is particularly important for northeastern India, where diverse cultural practices, dietary patterns, and healthcare challenges may influence disease patterns differently compared to other regions of the country. By systematically analyzing these variables, the study seeks to bridge existing knowledge gaps and contribute to improved diagnostic strategies, patient management, and preventive healthcare interventions. Ultimately, such research plays a vital role in reducing the burden of IDA, improving patient outcomes, and supporting national and global efforts toward anemia control

2. Methodology

2.1 Study Design

This study was conducted as a hospital-based observational study aimed at assessing the clinico-demographic profile of patients diagnosed with iron deficiency anemia (IDA).

2.2 Study Setting

The study was carried out in the Department of Medicine at Assam Medical College and Hospital, a tertiary care center located in Upper Assam.

2.3 Study Duration

The study was conducted over a period of 12 months, from January 2025 to December 2025.

2.4 Participants

Inclusion Criteria:

- Patients aged ≥13 years
- Patients with laboratory-confirmed iron deficiency anemia
- Patients admitted during the study period
- Patients who provided written informed consent

Exclusion Criteria:

- Patients with other types of anemia (e.g., hemolytic anemia, megaloblastic anemia, anemia of chronic disease)
- Pregnant and lactating women
- Patients with incomplete medical records

2.5 Study Sampling

A consecutive sampling technique was employed in this study. All eligible patients admitted to the Department of Medicine during the study period who met the inclusion criteria were included until the required sample size was achieved. This non-probability sampling method ensured feasibility in a hospital setting and minimized selection bias by including all accessible cases.

2.6 Study Sample Size

The sample size was calculated based on the prevalence of iron deficiency anemia among adolescents in Assam, which was reported as 17.5% in a previous study. Using a 95% confidence interval and an absolute error of 10%, the sample size was determined using the standard formula:

$$n = Z^2pq / d^2$$

Where $Z = 1.96$, $p = 0.175$, $q = 1 - p$, and $d = 0.10$. The calculated sample size was 62. This number was considered sufficient to achieve statistically meaningful results for descriptive analysis.

2.7 Study Parameters

The study included both independent and dependent variables. Independent variables comprised demographic factors such as age, gender, residence (rural/urban), occupation, socioeconomic status, and risk exposures including dietary habits, menstrual history, and history of chronic blood loss or infections. Dependent variables included clinical presentation (fatigue, pallor, dyspnea, palpitations, etc.), laboratory parameters (hemoglobin, MCV, MCHC, serum ferritin, serum iron, TIBC, transferrin saturation), and patient outcomes (discharge or mortality). These parameters were selected to comprehensively assess the clinical and etiological profile of IDA.

2.8 Study Procedure

All eligible patients admitted to the Department of Medicine were screened for iron deficiency anemia based on clinical suspicion and laboratory investigations. After confirming eligibility, informed consent was obtained from each participant. A detailed clinical history was taken, including dietary habits, menstrual and obstetric history, gastrointestinal symptoms, and past medical history. A thorough physical examination was conducted to assess general and systemic findings. Relevant laboratory investigations were performed to confirm the diagnosis and assess

2.9 Study Data Collection

Data were collected using a pre-designed and structured proforma. Information recorded included demographic

details (age, sex, occupation, residence), risk factors (dietary patterns, menstrual history, chronic blood loss, infections), clinical features (fatigue, pallor, dyspnea, palpitations, hair loss, pica), physical examination findings, and laboratory parameters. Data were obtained from patient interviews, clinical examination, and hospital records. All collected data were systematically documented to ensure accuracy and completeness.

2.10 Data Analysis

The collected data were entered into Microsoft Excel and analyzed using SPSS version 26. Descriptive statistics such as mean, standard deviation, frequencies, and percentages were used to summarize the data. Inferential statistical tests including the Chi-square test or Fisher's exact test were applied to assess associations between categorical variables. Continuous variables were analyzed using t-tests or ANOVA where appropriate. Logistic regression analysis was performed to identify independent predictors of severity and outcomes. A p-value of less than 0.05 was considered statistically significant.

2.11 Ethical Considerations

The study was conducted in accordance with ethical principles and guidelines. Approval was obtained from the Institutional Ethics Committee prior to initiation of the study. Written informed consent was obtained from all participants before enrollment. Confidentiality of patient information was strictly maintained by assigning unique identification numbers and restricting access to data. Participation in the study was voluntary, and patients were informed of their right to withdraw at any time without affecting their treatment. No additional risk was imposed on participants as the study involved routine clinical evaluation and investigations.

3. Results

Table 1: Association Between Socio-Demographic Variables and Severity of Anemia

Variable	Category	Moderate n (%)	Severe n (%)	Total	p-value
Age (years)	13–20	2 (20.0)	8 (80.0)	10	0.737
	21–30	1 (33.3)	2 (66.7)	3	
	31–40	5 (38.5)	8 (61.5)	13	
	41–50	5 (35.7)	9 (64.3)	14	
	51–60	3 (21.4)	11 (78.6)	14	
	>60	1 (12.5)	7 (87.5)	8	
Gender	Female	13 (38.2)	21 (61.8)	34	0.104
	Male	4 (14.8)	23 (85.2)	27	
Education	Illiterate	0 (0.0)	4 (100.0)	4	0.204
	Literate	17 (29.3)	41 (70.7)	58	
Occupation	Business	4 (19.0)	17 (81.0)	21	0.537
	Homemaker	10 (37.0)	17 (63.0)	27	
	Student	3 (27.3)	8 (72.7)	11	
	Others	0 (0.0)	3 (100.0)	3	
Socioeconomic Status	Lower	7 (28.0)	18 (72.0)	25	0.933
	Middle	10 (27.0)	27 (73.0)	37	

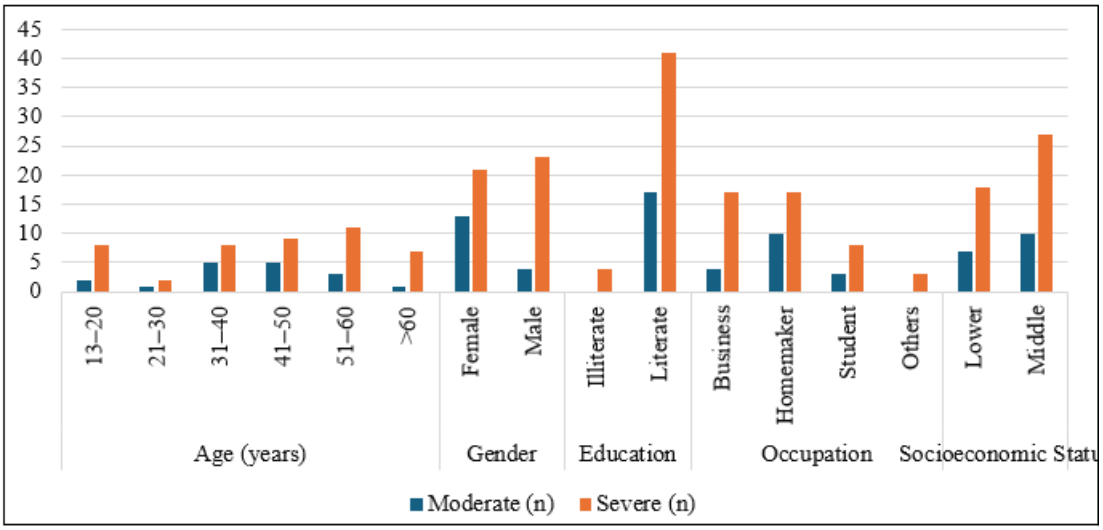

Table 2: Association Between Lifestyle and Clinical Factors with Severity

Variable	Category	Moderate n (%)	Severe n (%)	Total	p-value
Dietary Habit	Mixed	17 (28.3)	43 (71.7)	60	0.377
	Vegetarian	0 (0.0)	2 (100)	2	
Clinical Presentation	Fatigue	15 (34.1)	29 (65.9)	44	0.066
	Palpitation + Pallor	2 (11.1)	16 (88.9)	18	

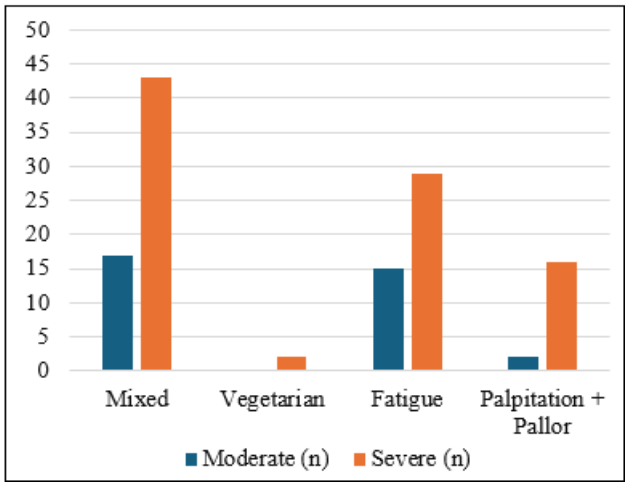

Table 3: Etiological Distribution and Its Association with Severity

Etiology	Moderate	Severe	Total	P value
Nutritional	11	10	21	0.254
UGI Bleed	3	7	10	
Menorrhagia	2	4	6	
Others (combined)	1	24	25	
Total	17	45	62	

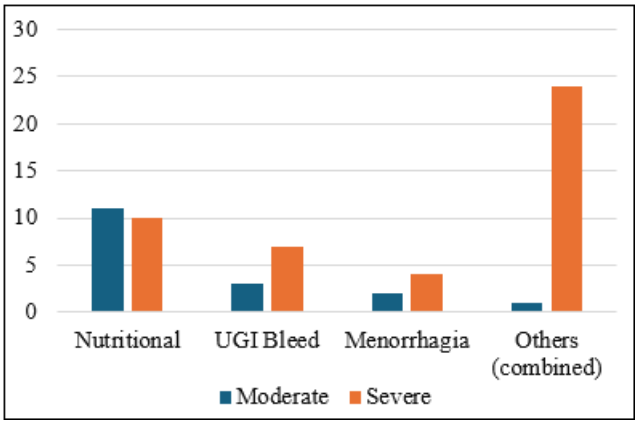

Table 4: Comparison of Mean Laboratory Parameters Between Moderate and Severe Anemia

Parameter	Moderate (Mean ± SD)	Severe (Mean ± SD)	p-value
Age	42.53 ± 14.22	45.24 ± 18.05	0.579
MCV	64.48 ± 16.82	68.43 ± 13.61	0.343
MCHC	29.52 ± 3.21	26.88 ± 4.21	*0.023 **
Serum Ferritin	17.54 ± 16.56	12.99 ± 13.37	0.268
Serum Iron	32.29 ± 30.33	28.51 ± 25.99	0.627
TIBC	387.94 ± 131.68	339.43 ± 111.38	0.151
Reticulocyte Count	3.73 ± 1.28	3.78 ± 1.37	0.893

4. Discussion

The present study evaluated the clinico-demographic profile, etiological distribution, and laboratory correlates of severity among patients with iron deficiency anemia (IDA) admitted to a tertiary care hospital in Upper Assam, and the findings highlight a substantial burden of advanced disease. Out of 62 patients, a significantly higher proportion presented with severe anemia (45 cases) compared to moderate anemia (17 cases), indicating late presentation and possibly inadequate early screening and awareness in the community. This trend of advanced presentation is consistent with hospital-based studies, where only a subset of anemic patients reach tertiary care with severe manifestations, as observed by Beverina (2019), [11] reported that among 22,329 patients, 27.5% were anemic but only 4.6% required transfusion, reflecting that severe cases disproportionately utilize hospital services.

Age-wise analysis in the present study showed that severe anemia was most prevalent in the elderly population, particularly in individuals aged >60 years (87.5%) and 51–60 years (78.6%), while a similarly high proportion was also seen among adolescents aged 13–20 years (80%). However, the association between age and severity was not statistically significant (p=0.737). This pattern suggests that both extremes of age are vulnerable due to increased physiological demands and comorbidities. Supporting this observation, Kumari et al. (2017) [12] reported that in an elderly population, 40% of patients belonged to the 65–69 years age group, with a predominance of males (70%), highlighting that anemia is common in older individuals and often associated with multiple underlying conditions. Furthermore, Kandiya et al. (2025) [13] found that patients with anemia of chronic disease were significantly older (68.4 ± 12.1 years) compared to those with IDA (55.2 ± 15.8 years, p<0.001), reinforcing the association between advancing age and more severe or complex anemia presentations.

Gender distribution in the present study revealed that males had a higher proportion of severe anemia (85.2%) compared to females (61.8%), although the association was not statistically significant (p=0.104). This finding contrasts with the widely reported higher prevalence of anemia among females but may reflect delayed healthcare-seeking behavior or occupational exposures among males. In contrast, Kumari (2017) [12] reported a high prevalence of anemia (50%) among adolescent girls, with 43.3% mild, 3.3% moderate, and 3.3% severe anemia, emphasizing the gender-specific burden in younger populations . Similarly, Enawgaw (2019) [14] reported that among pregnant women, 12.9% were anemic, with 75% mild, 21.4% moderate, and 3.6% severe anemia, highlighting that severity distribution varies depending on the study population. These differences suggest that gender-related factors influencing anemia severity are highly context-dependent.

Educational status analysis showed that all illiterate patients (100%) had severe anemia compared to 70.7% among literate individuals, although the association was not statistically significant (p=0.204). This trend indicates that lack of awareness and poor health literacy may contribute to delayed diagnosis and treatment. Similar findings have been reported in previous studies where lower education levels were associated with higher severity of anemia, reinforcing the importance of education in disease prevention and early detection [15].

Occupation-wise distribution demonstrated that severe anemia was most common among individuals engaged in business (81.0%), followed by students (72.7%) and homemakers (63.0%), while all patients in the “others” category had severe anemia (100%). Although the association was not statistically significant (p=0.537), these findings suggest that occupational and lifestyle factors, including

irregular dietary habits and stress, may influence disease severity. Socioeconomic status did not show a significant association (p=0.933), with similar proportions of severe anemia in both lower (72.0%) and middle (73.0%) socioeconomic groups. This indicates that IDA is prevalent across socioeconomic strata, likely due to widespread nutritional deficiencies and common environmental exposures. However, studies such as Enawgaw (2019) [14] have emphasized the role of socioeconomic and nutritional factors in anemia, suggesting that regional variations may influence these associations.

Dietary habit analysis revealed that 71.7% of individuals consuming a mixed diet had severe anemia, while all vegetarians (100%) presented with severe anemia, although the association was not statistically significant (p=0.377). This finding highlights that dietary quality, iron bioavailability, and absorption play a more critical role than diet type alone. Kumari (2017) [13] similarly reported a high prevalence of anemia (50%) among adolescent girls, underscoring the importance of nutritional deficiency as a major etiological factor.

Clinical presentation analysis showed that fatigue was the most common symptom, present in 44 patients, with 65.9% having severe anemia. Patients presenting with combined pallor and palpitations had a markedly higher proportion of severe anemia (88.9%), with a borderline p-value (0.066), suggesting that these symptoms may serve as clinical indicators of advanced disease. Similar clinical findings have been reported in other studies, where pallor was a common manifestation, emphasizing its importance as a clinical marker.

Etiological distribution in the present study showed that nutritional deficiency was the most common cause (21 cases), followed by upper gastrointestinal (UGI) bleeding (10 cases) and menorrhagia (6 cases). Notably, the “others” category accounted for the majority of severe cases (24 out of 25), indicating that multifactorial and chronic conditions significantly contribute to disease severity. Although the association between etiology and severity was not statistically significant (p=0.254), these findings align with Khadem et al. (2012), [16] reported that 50% of patients with IDA underwent endoscopy and significant gastrointestinal lesions, including cancer and high-risk adenomas, were detected in 20% of cases, highlighting the importance of gastrointestinal causes in IDA . Similarly, Khan (2023) [17] reported a high prevalence of anemia (51%) among adolescents, with iron deficiency anemia accounting for 34.3% of cases. Higher prevalence was observed in females, particularly in the 14–18 years age group. The study also identified poor dietary habits, low BMI, and lower socioeconomic status as significant contributing factors, highlighting the importance of nutrition and early intervention in preventing IDA.

Laboratory parameter comparison revealed that mean corpuscular hemoglobin concentration (MCHC) was significantly lower in severe anemia (26.88 ± 4.21) compared to moderate anemia (29.52 ± 3.21), with a p-value of 0.023, indicating more pronounced hypochromia in severe cases. Other parameters such as serum ferritin (12.99 ± 13.37 vs 17.54 ± 16.56), serum iron (28.51 ± 25.99 vs 32.29 ± 30.33), and total iron-binding capacity (339.43 ± 111.38 vs 387.94 ± 131.68) showed trends of greater iron depletion in severe anemia, although not statistically significant. These findings are consistent with the pathophysiology of IDA, where progressive iron depletion leads to hypochromic microcytic anemia. The present study demonstrates that severe anemia is highly prevalent and influenced by a multifactorial interplay of demographic, clinical, and etiological factors. Although most associations were not statistically significant, consistent trends indicate that age extremes, male gender, illiteracy, and multifactorial etiologies contribute to increased severity. Comparisons with previous studies reveal both similarities and differences, emphasizing the influence of population characteristics and regional factors. The findings underscore the urgent need for early screening, improved nutritional interventions, health education, and comprehensive management strategies to reduce the burden of iron deficiency anemia and prevent progression to severe disease

5. Conclusion

The present study concludes that iron deficiency anemia remains a significant health concern with a high proportion of patients presenting in advanced stages, reflecting delayed diagnosis and inadequate early intervention. The findings highlight that anemia severity is influenced by a combination of demographic, clinical, and etiological factors rather than a single determinant. Although associations with variables such as age, gender, education, occupation, and socioeconomic status were observed, they were not statistically significant, indicating the multifactorial nature of the condition. Nutritional deficiency emerged as a major contributing factor, along with other causes such as chronic blood loss and underlying conditions. Clinical features like fatigue and pallor were commonly observed and may aid in early identification of cases. Among laboratory parameters, indicators of red cell hypochromia were more closely associated with disease severity. Overall, the study emphasizes the need for increased awareness, early screening, and comprehensive management strategies, including nutritional interventions and timely treatment, to reduce the burden of iron deficiency anemia and improve patient outcomes.

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