

## ORIGINAL ARTICLE

# Severity and Types of Anemia in Female Patients: Experience from a Tertiary Care Hospital, Khulna

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## Abstract

**Background:** Anemia remains a common hematological disorder among females, with diverse severity, morphology and underlying etiology. Understanding its distribution across age groups is essential for better clinical evaluation and management.

**Objectives:** To assess the severity, morphological patterns and etiological classification of anemia in non-pregnant female patients attending a tertiary care hospital.

**Methods:** This cross-sectional study was conducted in the department of Pathology, Gazi Medical College & Hospital, Khulna, including 248 anemic non-pregnant female patients fulfilling the inclusion criteria. Complete blood counts were performed using an automated hematology analyzer, while peripheral blood films aided morphological and etiological classification. Data were analyzed with SPSS version 26. Statistical associations were tested using chi-square analysis.

**Results:** The most affected age group was 18–40 years (47.6%). Moderate anemia was predominant across all age groups (59.3%), followed by mild (32.2%) and severe anemia (8.5%). Morphologically, normocytic normochromic anemia (NNA) was the most frequent type (64.9%), followed by microcytic hypochromic anemia (26.2%) and macrocytic anemia (8.9%). Etiologically, unclassified NNA was most common (42.3%), while iron deficiency anemia (IDA) accounted for 22.2%. Statistically significant associations were observed between anemia severity and both morphological types ( $p < 0.005$ ) and etiological classifications ( $p < 0.001$ ) respectively.

**Conclusion:** Moderate anemia and normocytic normochromic pattern were predominant among non-pregnant females, with unclassified NNA and iron deficiency anemia being the leading etiological types. These findings highlight the need for thorough diagnostic evaluation to identify underlying causes and guide appropriate management strategies.

**Keywords:** Anemia, Female patients, Iron deficiency, Morphology, Etiology

## Introduction

Anemia is the most common haematological disorder all over the world.<sup>1</sup> According to World Health Organization (WHO), the prevalence of anemia is 30.7% among women of reproductive age globally.<sup>2</sup> It represents a major healthcare burden in developing countries like Bangladesh.<sup>3</sup> In Bangladesh, anemia affects 46% in pregnant women and 33% in

non-pregnant women.<sup>4</sup> The burden is considerably higher due to nutritional deficiencies, menstrual blood loss, repeated pregnancies and poor socioeconomic status.<sup>5</sup> There is significant association of anemia with morbidity and mortality of a patient as well.<sup>6</sup>

Anemia encompasses a broad range of multiple aetiologies, including nutritional deficiencies (iron, folate, vitamin B12), chronic blood loss, systemic illnesses, bone marrow suppression, parasitic infestation and hereditary disorders such as thalassemia. This broad etiological spectrum highlights the importance of morphological classification to guide further evaluation and management.<sup>7</sup>

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Morphologically anemia can be classified based on the size and hemoglobin content of red blood cells. They are divided into normocytic, microcytic and macrocytic anemias depending on size and normochromic or hypochromic anemias based on hemoglobinization levels.<sup>8</sup> Morphological classification of anemia by PBF examination can provide insight into the underlying etiologies such as iron deficiency, vitamin B12/folate deficiency or chronic disease to a greater extent.<sup>9</sup>

As recent studies suggest that causes of anemia are complex and context specific. Efforts are needed to better understand how the principal causes of anemia—including iron deficiency, other micronutrient deficiencies, chronic disease and hemoglobin disorders—contribute to its burden, so that appropriate and targeted interventions can be implemented in specific settings.<sup>10</sup>

There are several methods by which anemia can be detected and classification of anemia can be established. Complete blood count (CBC) generated by haematology auto analyzer and microscopic examination of peripheral blood film (PBF) of blood slide are among them.<sup>11</sup>

In Bangladesh, anemia among women remains a major public health issue.<sup>4</sup> Khulna, being one of the major divisions of southern region of Bangladesh, has a diverse population with significant rural communities where nutritional deficiencies and limited access to health care contribute to higher anemia burden.<sup>12</sup> Females, particularly adolescents and women of reproductive age, are disproportionately affected by anemia due to increased physiological demands, menstrual blood loss, nutritional deficiencies, repeated pregnancy, absence of deworming interventions and ignorance about sanitation.<sup>13</sup>

By focusing on this group, the study aimed to reflect the severity and different types of anemia among women in this region. The findings will help in planning targeted interventions such as nutrition programs, iron supplementation and health education.

### Materials and Methods

This cross-sectional study was conducted in the Department of Pathology, Gazi Medical College Hospital (GMCH), Khulna from March to July, 2025. During this study period 248 female anemic patients

requested for CBC investigation and met the sample acceptance criteria according to standard operating procedure (SOP) in GMCH, Khulna were enrolled by purposive sampling. All laboratory investigations were carried in the department of pathology, GMCH.

### Patient selection

#### Inclusion criteria

All the nonpregnant female patients from 18 years onward, diagnosed with anemia according to 'WHO guideline to define anemia: 2024' were included in the study.<sup>14</sup>

#### Exclusion criteria

Inadequate amounts of blood samples, clotted specimens, hemolyzed specimens or specimens with wrong vacutainer were excluded.

### Laboratory procedure

#### Test procedure

##### Complete blood count

Hematological parameters were carried out by SYSMEX Automated Hematology Analyzer (Model: XN-550). The hemoglobin concentration (Hb%), red cell distribution width (RDW), red blood cell (RBC) indices including mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) were obtained.

##### Microscopic examination of peripheral blood film

Microscopic examination of all peripheral blood film (PBF) slides (stained with Leishman stain) was done.

#### Ethical consideration

Prior to the commencement of this study, the research protocol was approved by the Ethical Institutional Review Board (IRB) of Gazi Medical College, Khulna. Informed consent was taken from the study participants. All information collected was kept confidential.

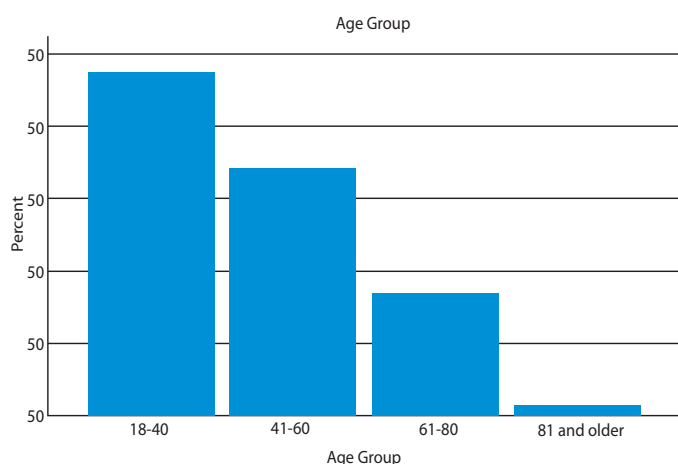
#### Statistical Analysis

All statistical computations were performed by window-based computer software devised with Statistical Packages for Social Sciences (IBM SPSS Statistics 26 version). The results were presented with tables and bars, where applicable. Pearson Chi-square test was performed to analyze the association between the types of anemia and its severity. For all statistical tests we considered p value <0.05 as statistically significant.

## Results

This cross-sectional study was carried out in the department of Pathology in Gazi Medical College & Hospital, Khulna. A total of 248 anemic non-pregnant female patients were enrolled in this study according to the inclusion criteria.

Figure-1 presented the age group distribution of anemic patients. According to age, the most common affected age group was between 18-40 years in our study with 47.6% cases.



**Fig-1: Distribution of Anemia According to Age Group (n=248).**

Moderate anemia was most prevalent (59.3%) in all the age groups compared to mild and severe anemia.

**Table-I: Distribution of severity of anemia according to Age Groups (n=248)**

| Age in years | Anemia Severity (%)  |                       |                     |
|--------------|----------------------|-----------------------|---------------------|
|              | Mild                 | Moderate              | Severe              |
| 18-40        | 41<br>(34.7)         | 69<br>(58.5)          | 08<br>(6.8)         |
| 41-60        | 27<br>(31.8)         | 50<br>(58.8)          | 08<br>(9.4)         |
| 61-80        | 12<br>(28.6)         | 25<br>(59.5)          | 05<br>(11.9)        |
| 81 and older | 0<br>(0)             | 03<br>(100)           | 0<br>(0)            |
| <b>Total</b> | <b>80<br/>(32.2)</b> | <b>147<br/>(59.3)</b> | <b>21<br/>(8.5)</b> |

PBF examination stated that the predominant morphological type of anemia was normocytic normochromic anemia (NNA), followed by microcytic hypochromic anemia (MHA) in Table-II.

**Table-II: Morphological types of anemia in different age group of patients (n=248)**

| Age in years | MA<br>n (%)         | MHA<br>n (%)         | NNA<br>n (%)          |
|--------------|---------------------|----------------------|-----------------------|
| 18-40        | 7<br>(5.9)          | 35<br>(29.7)         | 76<br>(64.4)          |
| 41-60        | 4<br>(4.7)          | 20<br>(23.5)         | 60<br>(71.8)          |
| 61-80        | 10<br>(23.8)        | 10<br>(23.8)         | 22<br>(52.4)          |
| 81 and older | 1<br>(33.3)         | 0<br>(0)             | 2<br>(66.7)           |
| <b>Total</b> | <b>22<br/>(8.9)</b> | <b>65<br/>(26.2)</b> | <b>161<br/>(64.9)</b> |

| Age in (years) | ACD<br>n (%)     | IDA<br>n (%)     | NNA<br>(unclassified)<br>n (%) |
|----------------|------------------|------------------|--------------------------------|
| 18-40          | 9 (7.6)          | 32 (27.1)        | 59 (50.0)                      |
| 41-60          | 26 (30.6)        | 15 (17.6)        | 30 (35.3)                      |
| 61-80          | 7 (16.7)         | 8 (19.0)         | 14 (33.3)                      |
| ≥81            | 0 (0.0)          | 0 (0.0)          | 2 (66.7)                       |
| <b>Total</b>   | <b>42 (16.9)</b> | <b>55 (22.2)</b> | <b>105 (42.3)</b>              |

(MA=Macrocytic anemia; MHA=Microcytic hypochromic anemia; NNA=Normocytic normochromic anemia)

Table-III showed that normocytic normochromic anemia (unclassified) was 105 (42.3%). Iron deficiency anemia (IDA) was 55 (22.2%) among microcytic hypochromic anemia.

**Table-III: Aetiological classification of anemia based on peripheral blood film examination (n=248)**

| Age in (years) | ACD<br>n (%)     | IDA<br>n (%)     | NNA<br>(unclassified)<br>n (%) |
|----------------|------------------|------------------|--------------------------------|
| 18-40          | 9 (7.6)          | 32 (27.1)        | 59 (50.0)                      |
| 41-60          | 26 (30.6)        | 15 (17.6)        | 30 (35.3)                      |
| 61-80          | 7 (16.7)         | 8 (19.0)         | 14 (33.3)                      |
| ≥81            | 0 (0.0)          | 0 (0.0)          | 2 (66.7)                       |
| <b>Total</b>   | <b>42 (16.9)</b> | <b>55 (22.2)</b> | <b>105 (42.3)</b>              |

| Age (years)  | CDA<br>n (%)       | HA<br>n (%)         | MA<br>n (%)         | Thalassemia<br>n (%) |
|--------------|--------------------|---------------------|---------------------|----------------------|
| 18-40        | 5<br>(4.2)         | 3<br>(2.5)          | 7<br>(5.9)          | 3<br>(2.5)           |
| 41-60        | 2<br>(2.4)         | 6<br>(7.1)          | 4<br>(4.7)          | 2<br>(2.4)           |
| 61-80        | 1<br>(2.4)         | 2<br>(4.8)          | 10<br>(23.8)        | 0<br>(0.0)           |
| ≥81          | 0<br>(0.0)         | 0<br>(0.0)          | 1<br>(33.3)         | 0<br>(0.0)           |
| <b>Total</b> | <b>8<br/>(3.2)</b> | <b>11<br/>(4.4)</b> | <b>22<br/>(8.9)</b> | <b>5<br/>(2.0)</b>   |

(ACD = Anemia of chronic disorder; IDA = Iron deficiency anemia; NNA = Normocytic normochromic anemia; CDA = Combined deficiency anemia; HA = Hemolytic anemia; MA = Macrocytic anemia)

In table-IV association of morphological types of anemia and severity of anemia of the patients was analysed which was statistically significant ( $p < 0.05$ ).

**Table-IV: Association of morphological types of anemia and severity of anemia of the patients (n=248)**

| Types of anemia | Mild | Moderate | Severe | Chi-sq | P-value |
|-----------------|------|----------|--------|--------|---------|
| NNA             | 61   | 91       | 9      | 14.682 | 0.005   |
| MHA             | 10   | 46       | 9      |        |         |
| MA              | 09   | 10       | 3      |        |         |

(NNA=Normocytic normochromic anemia; MHA=Microcytic hypochromic anemia; MA=Macrocytic anemia)

In table-V association of aetiological types of anemia and severity of anemia of the patients was analysed which was statistically significant ( $P < 0.05$ ).

**Table-V: Association of aetiological types of anemia (based on PBF examination) and severity of anemia of the patients (n=248)**

| Aetiological Types | Mild | Moderate | Severe | Chi-sq | P-value |
|--------------------|------|----------|--------|--------|---------|
| ACD                | 7    | 33       | 2      | 78.1   | 0.0     |
| CDA                | 1    | 6        | 1      |        |         |
| HA                 | 0    | 5        | 6      |        |         |
| IDA                | 6    | 42       | 7      | 88     | 00      |
| MA                 | 9    | 10       | 3      |        |         |
| NNA                | 55   | 49       | 1      |        |         |
| (Unclassified)     |      |          |        |        |         |
| Thalassemia        | 2    | 2        | 1      |        |         |

(ACD = Anemia of chronic disorder; CDA = Combined deficiency anemia; HA= Hemolytic anemia; IDA= Iron deficiency anemia; MA= Macrocytic anemia; NNA = Normocytic normochromic anemia)

## Discussion

The present study was conducted to determine the severity and types of anemia among female non-pregnant patients in Khulna. Among 248 patients the majority of cases lie between the age group 18-40 years which was 118 (47.6%) in numbers. This result is consistent with the studies of Sagar K D et al and Ramya G et al.<sup>8,15</sup>

In terms of severity, the present study demonstrated that the majority of patients were classified as having moderate anemia (59.3%) followed by mild cases (32.2%), while severe anemia (8.5%) constituted the

lesser proportion. This pattern is comparable to the findings of Agarwal et al., Thyagaraju et al., Ramya G et al., Singh A B et al. and Krishnan G et al., who also reported moderate anemia as the most common category among their study populations.<sup>1,6,15,17,18</sup> Conversely, Burdak et al. and Fardous F et al. reported that mild anemia was predominant in their studies.<sup>10,13</sup> On the other hand in the study of Beyene W et al., severe anemia was the major type of anemia.<sup>19</sup> Variations across these studies may therefore be attributed to differences in socioeconomic conditions, dietary practices, burden of chronic diseases and availability of healthcare services.<sup>20</sup> Overall, the predominance of moderate anemia in our study highlights the importance of early detection and timely intervention to prevent progression to severe, life-threatening anemia.

In the present study, peripheral blood film examination revealed that the predominant morphological type of anemia across all age groups was normocytic normochromic anemia (NNA), accounting for 161 (64.9%) cases. This was followed by microcytic hypochromic anemia (MHA) in 65 (26.2%) cases and macrocytic anemia (MA) in 22 (8.9%) cases. Similar findings were reported by Agarwal et al., and Thyagaraju et al. where NNA was the most prevalent morphological pattern (57.26%) and (54.4%) respectively.<sup>1,6</sup> In contrast, studies by Krishnan et al., Beyene et al. and Pandey B et al. reported MHA as the most common morphological pattern, followed by NNA.<sup>18,19,21</sup> Such variation in the distribution of anemia types across different populations may be attributed to differences in study settings, underlying etiologies, sample size variation.<sup>22</sup>

The aetiological classification of anemia based on peripheral blood film (PBF) examination revealed that the most common type was normocytic normochromic anemia (NNA) in 105 (42.3%) cases. Normocytic normochromic anemia (NNA) may arise from widely varying etiologies, including chronic inflammatory disorders, bone marrow failure, chronic kidney disease and others.<sup>9</sup> In the present study, however, the causes underlying NNA were not specifically investigated and confirmed and therefore this category was reported as unclassified. Findings from Agarwal et al. and Thyagaraju et al. similarly reported NNA as the predominant etiological category of anemia.<sup>1,6</sup> Among microcytic hypochromic anemia iron deficiency anemia (IDA) was the most common subtype which was

present in 55 (22.2%) cases. These findings were in accordance with the studies of Fardaus et al., Ramya G et al., and Krishnan et al.<sup>13,15,18</sup>

Although microcytic hypochromic anemia may also arise from thalassemia, anemia of chronic disease and sideroblastic anemia, iron deficiency remains the leading cause in the most populations.<sup>16</sup> This high prevalence of IDA can be attributed to poor dietary intake, increased physiological demands during pregnancy and lactation, and pathological chronic blood loss, particularly menstrual blood loss among women of reproductive age.<sup>12,16</sup> In our study the patients of anemia of chronic disorder (ACD) were in 42 (16.9%) cases. Notably, some patients diagnosed with early-stage of ACD presented morphologically as NNA, whereas others exhibited microcytic hypochromic features. Macrocytic anemia (MA) was observed in 22 (8.9) cases, hemolytic anemia (HA) in 11 (4.4%) cases, combined deficiency anemia (CDA) in 8 (3.2%) cases and thalassemia in 5(2%) cases as well.

The present study found a statistically significant association between the morphological types of anemia and its severity among the patients ( $\chi^2 = 14.682$ ,  $p = 0.005$ ). Normocytic normochromic anemia (NNA) was the most frequent type observed across all grades of severity, being predominant in both mild (61 cases) and moderate anemia (91 cases) which were in accordance with the studies of Bhadran et al. and Krishnan R. et al.<sup>23,24</sup>

The relatively high occurrence of MHA in moderate and severe categories is consistent with nutritional deficiencies, especially iron deficiency, which is common in developing regions.<sup>8,19</sup> The low prevalence of MA in this study population aligns with global patterns where megaloblastic anemia contributes to a smaller proportion of cases.<sup>9</sup>

In the present study, a statistically significant association was found between the etiological types of anemia and the severity of anemia among the patients ( $\chi^2 = 78.188$ ,  $p < 0.001$ ). Normocytic normochromic anemia (NNA) was most frequent in mild anemia (55 cases) and remained high in moderate cases (49), but decreased sharply in severe anemia (1 case). The predominance of NNA in moderate anemia, may reflect underlying chronic diseases, renal disorders or marrow suppression.<sup>9</sup> Iron deficiency anemia (IDA) was concentrated in moderate anemia (42 cases) and contributed substantially to severe anemia (7 cases) which was also found in hemolytic anemia (6 cases). These findings are consistent with the studies of Burdak

et al., Bhadran et al. and Krishnan R. et al.<sup>8, 23,24</sup>

In conclusion, the findings of our study highlight the importance of considering the association of anemia not only with severity but also with its morphological and etiological patterns, as these reflect the underlying causes and can guide more targeted interventions.

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### Conflict of interest

None declared.

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