

Age and Gender-Specific Prevalence of Anemia in Rural Bhopal, Central India

Running Head: Anemia Prevalence in Rural Bhopal

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Abbreviations:

CDC, Centres for Disease Control and Prevention

FBC, Full blood count

Hb, Haemoglobin

HSE, Health Survey for England

ID, Iron deficiency

IDA, Iron deficiency anaemia

NICE, National Institute for Health and Care Excellence

NHS, National Health Service

UKNSC, UK National Screening Committee

WHO, World Health Organisation

Abstract

Background: Anemia is a major global health problem, especially in developing countries like India, where prevalence is approximately 51%. Iron deficiency anemia (IDA) is the most common nutritional anemia. IDA impacts various age groups, with significant implications for pregnant women and children.

Methods: This study included 150 patients with anemia from medical outpatients department and indoor wards in different age groups, selected randomly without bias for sex, occupation, and duration of disease. Data was collected from a rural area and Red Cross Hospital and Pushpanjali Hospital, Trilanga, Bhopal. Inclusion criteria included patients aged 6 months to 20 years and more, with symptoms and preliminary investigation (Hb level, peripheral blood smear) suggestive of anemia. Laboratory tests included Complete Blood Count, Hb% by Sahli's method and autoanalyzer, Peripheral blood smear, Serum iron, Total Iron-Binding Capacity (TIBC), and serum ferritin.

Results: The maximum number of patients (40%) were from the age group 21-30 years. Prevalence of anemia was higher in females than males in the 15-30 years age group. The study population had 57% moderate anemia and 41% severe anemia. Weakness & easy fatigability were the most common (100%) presenting symptoms, and pallor was the most common (98% patients) clinical sign. Microcytic and hypochromic type peripheral smear was the most common laboratory finding (59% cases). Nutritional anemia was identified as the most common type of anemia (84%).

Conclusion: Nutritional deficiency anemia is the most common cause of anemia among the population, with iron deficiency being the most common nutritional deficiency.

Keywords

Anemia, Iron deficiency, Microcytic anemia, Nutritional anemia.

Introduction

Anemia is a major global health problem, particularly in developing countries like India, despite being largely preventable and easily treatable. Globally, nearly one-third of the population suffers from anemia due to various causes, with India exhibiting a very high prevalence of approximately 51%. The term "Anemia" refers to a reduction below normal in the concentration of hemoglobin, Hematocrit, or Red Blood Cells (RBCs) in the blood, with the hemoglobin level being the preferred measure[1],[2].

The most common type of anemia in developing countries is **nutritional anemia**, primarily **Iron Deficiency Anemia (IDA)**. Nutritional anemia can also be caused by Folic acid deficiency, Vitamin B12 deficiency, or a combination of these factors. Other types include hemolytic anemia (congenital or acquired), aplastic anemia, anemia due to blood loss, and anemia of chronic disease.

Iron Deficiency Anemia (IDA)

IDA occurs when there is a decreased level of hemoglobin (the oxygen-carrying protein) in the RBCs, which is a result of insufficient iron in the body. In women of childbearing age, heavy menstruation or pregnancy are the most common causes of iron loss. Poor diet, impaired iron absorption due to intestinal diseases (e.g., celiac disease, gastric bypass surgery), or internal bleeding (e.g., ulcers, polyps, regular use of aspirin) can also cause IDA[3].

Pathophysiology of IDA

Iron is essential for multiple metabolic processes, including oxygen transport and DNA synthesis. Iron equilibrium is regulated by a balance between absorption and body losses. The body typically absorbs 1 mg daily to maintain equilibrium, though the internal requirement is much greater (20-25 mg) due to RBC turnover. Iron deficiency results from either **diminished absorbable dietary iron** or **excessive loss of body iron**[4]. Hemorrhage is the most common cause of excessive iron loss. Dietary iron is absorbed in the proximal small bowel via three pathways: the heme pathway, and two distinct pathways for ferric and ferrous iron.

Symptoms of IDA

Symptoms of moderate to severe IDA include:

- General fatigue and weakness
- Pale skin and pallor
- Shortness of breath
- Dizziness
- Strange cravings (pica) to eat items such as dirt, ice, or clay
- Tingling/crawling feeling in the legs

- Tongue swelling or soreness
- Cold hands and feet
- Fast or irregular heartbeat
- Brittle nails (koilonychias)
- Headaches

Methods

Need, Aim, and Objectives

Iron deficiency anemia is a common nutritional anemia, and in the rural area of Bhopal, people were not fully aware of nutritional diet requirements. The **AIM** of this study was to analyze the prevalence and severity of anemia by sex and gender in the rural area of Bhopal, Madhya Pradesh.

The specific **OBJECTIVES** were to:

- Determine the Complete Blood Count (CBC).
- Study the Hb% by Sahli's method and autoanalyzer.
- Study IDA according to age, gender, and signs and symptoms.
- Study the Peripheral blood smear.
- Study Serum iron, total iron-binding capacity (TIBC), and serum ferritin.

The **Hypotheses** tested were:

- **Null Hypothesis:** There are no significant variations in males, whereas female and children has been changed acc. to Hb%.
- **Alternate Hypothesis:** There are significant variations acc. to Hb% in females and children whereas mild variations in males.

Study Design and Patient Selection

This was an observational study. A total of 150 patients of anemia were selected from medical outpatients department and indoor wards of Red Cross Hospital and Pushpanjali Hospital, Trilanga, Bhopal. Patients were randomly selected without any predisposition for sex, occupation, or duration of disease. The study was approved by hospital staff.

Inclusion Criteria:

1. Patients aged 6 months to 20 years and more.
2. Patients with symptoms, signs, and preliminary investigation (e.g., hemoglobin level, peripheral blood smear) suggestive of anemia.

Exclusion Criteria:

1. All the patients aged below 25 years (This appears to be a typo/contradiction to inclusion criteria).
2. Patients suffering from chronic infection and depends on symptoms seen.

A detailed history was recorded with particular focus on symptoms suggestive of anemia such as weakness, decreased work performance, breathlessness on exertion, and pale skin.

Laboratory Investigations

The following investigations were performed to establish the diagnosis and etiology of anemia:

- **Complete Blood Count (CBC):** Used to determine low mean corpuscular volume (MCV) and low mean corpuscular hemoglobin concentration (MCHC).
- **Hemoglobin Estimation (Hb%):** Performed by Sahli's method and autoanalyzer.
- **Peripheral Blood Smear:** Examined for microcytic and hypochromic RBCs.
- **Iron Studies:** Serum iron, total iron-binding capacity (TIBC), and serum ferritin were measured. Low serum iron and ferritin with an elevated TIBC are diagnostic of iron deficiency

Results

Demographic and Clinical Profile

- **Age Distribution:** The highest prevalence of patients (40%) was observed in the 21-30 years age group.
- **Gender Prevalence:** The prevalence of anemia was greater in females than males in the 15-30 years age group.
- **Symptoms and Signs:** **Weakness & easy fatigability** were the most common presenting symptoms (100% of patients). **Pallor of conjunctiva** was the most common clinical sign, observed in 98% of patients. Other signs included nail changes (60%), typical koilonychias (30%), edema, hepatomegaly, and tachycardia (40% each).

Hematological Findings

- **Severity of Anemia:** 57% of the study population had **moderate anemia**, and 41% had **severe anemia**.
- **Morphological Type:** The most common laboratory finding was a **Microcytic and hypochromic type peripheral smear** (59% of cases).
- **Etiological Type:** **Nutritional anemia** was the most common type of anemia, present in 84% of cases.

Iron Studies

- **Serum Iron:** 24% of patients had a serum iron level of $< 30 \mu\text{g/dl}$, while 60% of patients had a level between 30-60 $\mu\text{g/dl}$.

Discussion

The study findings highlight the significant burden of nutritional anemia, specifically iron deficiency, in the rural Bhopal population, consistent with findings from other studies in India and developing nations. The high proportion of microcytic and hypochromic smears (59%) and the fact that nutritional anemia accounted for 84% of cases strongly suggest iron deficiency as the primary cause.

The observation that the prevalence of anemia is greater in women, particularly in the reproductive age group (15-30 years), aligns with the known risk factors of heavy menstrual bleeding and pregnancy-related iron loss. The symptoms observed, such as weakness, fatigability, and pallor (98-100% prevalence), are classic manifestations of anemia.

Iron deficiency anemia is generally an easily treated disorder with an excellent outcome, provided the underlying cause is addressed. Treatment involves iron supplements, dietary modification to increase iron-rich foods (red meat, dark leafy vegetables) and Vitamin C (which aids absorption), and treating the cause of bleeding (e.g., birth control pills for heavy periods).

However, the prognosis can be influenced by underlying comorbid conditions or if the IDA is secondary to a condition with a poor outlook, such as neoplasia. Chronic moderate or severe IDA can aggravate underlying cardiovascular and pulmonary disorders due to hypoxia. In children, IDA is associated with slowed growth rate, diminished learning capability, and a lower intelligence quotient (IQ). Prompt and adequate treatment is crucial, especially for symptomatic patients and children.

Conclusion

Nutritional deficiency anemia is the most common cause of anemia among the studied population, with iron deficiency being the most common nutritional deficiency. This necessitates targeted public health interventions focusing on dietary education and iron supplementation in the rural areas of Central India.

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