WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.453
Volume 14, Issue 12, 740-761. Review Article ISSN 2277–7105

# ANAEMIA IN PREGNANCY: A HOSPITAL-BASED COMPREHENSIVE REVIEW OF PREVALENCE, TYPES, AND MATERNAL OUTCOME

**L.Tejasri[1], M. Vanaja[2], M. Gowthami[3], B. Prasad Rao[4], Dr. M. Purushothaman[5], Rajani G.[6]***

[1-4]Department of Pharmacy Practice, KLR Pharmacy College, India.
[5]Professor, Department of Pharmaceutics, KLR Pharmacy College, India.
[6]Associate Professor, Department of Pharmacy Practice, KLR Pharmacy College, India.

Article Received on
03 May 2025,
Revised on 24 May 2025,
Accepted on 13 June 2025
DOI:10.20959/wjpr202512-37256

***Corresponding Author**
**Rajani G.**
Associate Professor, Department of Pharmacy Practice, KLR Pharmacy College, India.

## ABSTRACT

Anaemia in pregnancy is a major global health concern, particularly in developing countries, where it contributes significantly to maternal and neonatal morbidity and mortality. This review critically examines hospital-based data on the prevalence, types, risk factors, and maternal outcomes of anaemia during pregnancy. The condition is characterized by low haemoglobin levels that impair oxygen transport, affecting both mother and foetus. Iron deficiency is identified as the leading cause, with additional contributions from nutritional deficiencies, parasitic infections, and socio-economic challenges. The review highlights the high prevalence of anaemia among pregnant women attending tertiary care hospitals, with moderate severity being most common. Anaemia during pregnancy is linked to a heightened risk of maternal complications such as preeclampsia, postpartum haemorrhage, increased susceptibility to infections, and a greater likelihood of maternal mortality. Neonatal outcomes affected by maternal anaemia include low birth weight, preterm delivery, and stillbirth. Hospital-based studies emphasize the importance of early diagnosis through routine screening, effective management with iron and folic acid supplementation, and addressing underlying causes such as poor nutrition and infections. The findings underscore the urgent need for integrated healthcare strategies to reduce the burden of anaemia in pregnancy, thereby improving maternal and neonatal health outcomes in hospital settings and beyond.

**KEYWORDS**: Anaemia, Pregnancy, Maternal Outcome, Iron Deficiency, Hospital-Based Study, Prevalence, Public Health.

## 1. INTRODUCTION

Anaemia in pregnancy remains a significant public health challenge worldwide, particularly in low- and middle-income countries, where it contributes substantially to maternal and foetal morbidity and mortality. Defined by the World Health Organization (WHO) as a haemoglobin concentration less than 11 g/dL, anaemia in pregnancy increases in prevalence due to physiological changes, poor nutrition, and inadequate antenatal care. The haemodilutional effect of pregnancy further lowers haemoglobin concentration, thus amplifying the risk in women who enter pregnancy with depleted iron stores or pre-existing nutritional deficiencies.[1]

Anaemia affects nearly 40% of pregnant women across the globe, with South Asia and Sub-Saharan Africa reporting the highest rates of prevalence. According to WHO, this translates to over 32 million affected women worldwide, with severe consequences for both mother and child.[2] In India, the burden is disproportionately high, with hospital-based prevalence ranging from 40% to 80%, reflecting a complex interplay of socio-economic, dietary, environmental, and healthcare access factors.[3] The National Family Health Survey (NFHS-5) indicated that nearly 52.2% of pregnant women in India are anaemic, despite the presence of national supplementation programmes.[4]

The impact of anaemia on maternal outcomes is profound. Anaemia during pregnancy elevates the likelihood of complications such as extreme fatigue, heightened vulnerability to infections, cardiac failure, preeclampsia, placental detachment, and excessive bleeding after childbirth. Foetal complications associated with maternal anaemia include intrauterine growth restriction (IUGR), preterm birth, low birth weight, and higher neonatal mortality rates.[5] Severe anaemia may result in inadequate oxygen transport to the foetus, leading to poor Apgar scores, delayed neurodevelopment, and perinatal asphyxia.[6]

Iron deficiency anaemia (IDA) represents the most prevalent type of anaemia in pregnancy, contributing to approximately 50–60% of all reported cases. The major causes include poor dietary intake, low bioavailability of iron, parasitic infections, frequent pregnancies, and blood loss.[7] Other types of anaemia seen in pregnancy include megaloblastic anaemia (due to folate and vitamin B12 deficiency), sickle cell disease, and thalassemia syndromes.[8]

Hospital-based studies provide crucial insights into the burden and patterns of anaemia, allowing for a better understanding of clinical presentations, risk factors, and outcomes in controlled settings. These studies also serve as benchmarks to assess the effectiveness of national interventions like iron and folic acid supplementation, nutrition education, and deworming.[9] Despite the long-standing implementation of such programmes, including the Anemia Mukt Bharat (AMB) initiative, the persistently high prevalence suggests a gap in compliance, awareness, and health system reach.[10]

Therefore, this hospital-based review aims to present a comprehensive evaluation of the prevalence, types, and maternal outcomes associated with anaemia in pregnancy. Such data are essential to guide targeted strategies for prevention, early detection, and effective management, ultimately contributing to the reduction of maternal and neonatal complications in resource-limited settings.

## 2. EPIDEMIOLOGY AND PREVALENCE

### 2.1 Global Perspective

Anaemia during pregnancy remains a widespread and persistent global health concern. The Global Nutrition Report (2021) estimates that more than 500 million women are affected by anaemia each year, playing a major role in increasing both maternal and fetal illness and death rates.[11] The highest burden is observed in low- and middle-income countries, particularly in Sub-Saharan Africa, South Asia, and Southeast Asia, where nutritional deficiencies, recurrent infections, and poor health infrastructure are prevalent.[12] In these regions, anaemia prevalence among pregnant women ranges from 40% to over 60%, depending on local dietary patterns, sanitation levels, and access to antenatal care services.[13]

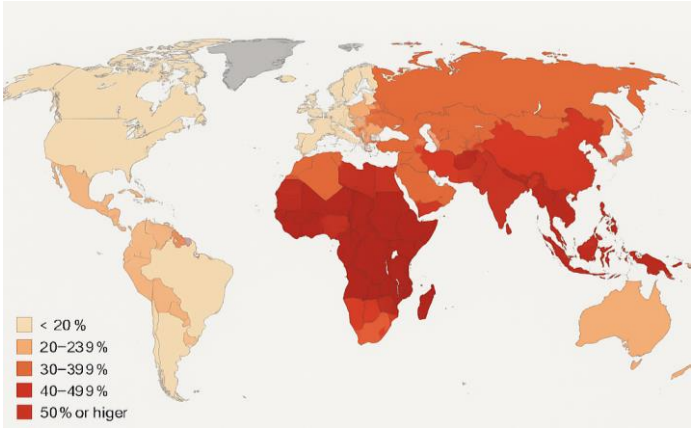


**Figure 1: Global prevalence of anaemia in pregnancy. Highest rates are seen in Sub-Saharan Africa and South Asia (Source: WHO, 2021).**

Multiple global health organizations, including the WHO and UNICEF, have identified anaemia as a key indicator of maternal health and nutrition. However, despite ongoing interventions and international commitments, progress in reducing anaemia rates has been sluggish. Factors such as high fertility rates, short inter-pregnancy intervals, and inadequate iron supplementation programs continue to contribute to its persistence.[14] Even in middle-income countries, gaps in nutritional literacy and adherence to iron–folic acid (IFA) therapy have led to continued challenges in anaemia management.[15]

**Table 1: Global Anaemia Estimates in Pregnant Women by Region, 2019–2021].**

| S.No. | Region | Anaemia Prevalence (%) | Severity Distribution |
|---|---|---|---|
| 1 | Sub-Saharan Africa | 56.0% | Mostly moderate |
| 2 | South Asia | 52.0% | Moderate to severe |
| 3 | Southeast Asia | 48.0% | Mild to moderate |
| 4 | Latin America | 32.0% | Mild |
| 5 | High-Income Countries | 16.0% | Predominantly mild |

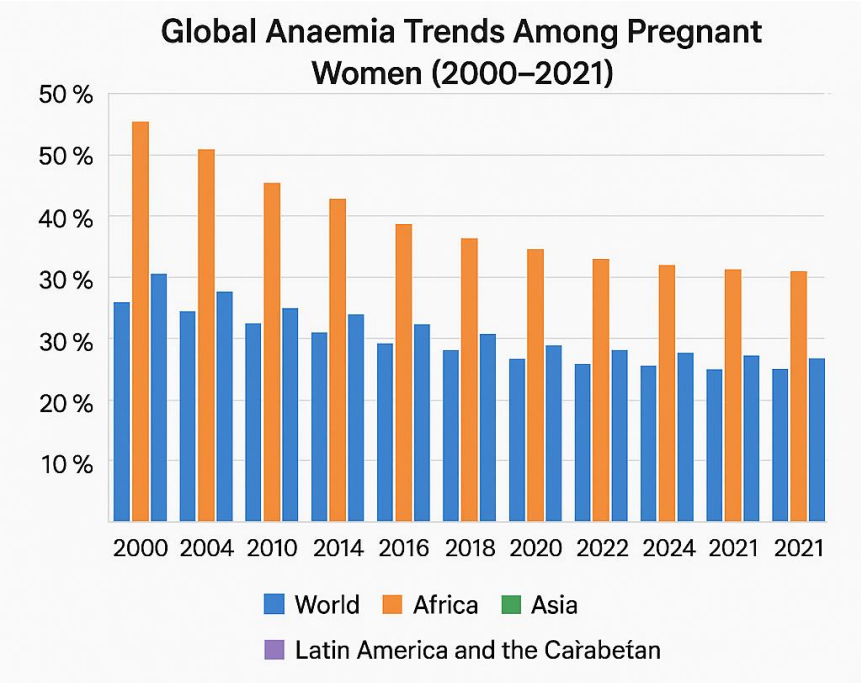


**Figure 2: Global time trend showing stagnation in anaemia reduction in LMICs from 2000 to 2021**.

### 2.2 Hospital-Based Data from India

India bears one of the heaviest burdens of maternal anaemia globally, contributing significantly to the worldwide caseload. Hospital-based studies across the country reflect considerable regional variations in prevalence, largely shaped by demographic, nutritional, and healthcare access differences.

**Table 2: Prevalence of Anaemia in Indian Tertiary Hospitals.**

| S. No. | Location | Hospital Type | Prevalence (%) | Most Common Severity |
|---|---|---|---|---|
| 1 | Tamil Nadu | Govt. Tertiary Hospital | 72% | Moderate |
| 2 | Andhra Pradesh | Tertiary Hospital | 63% | Moderate to severe |
| 3 | Rural Karnataka | CHC/PHC | 76% | Moderate |
| 4 | Urban Maharashtra | Private Hospital | 51% | Mild |

For instance, a study conducted in a government tertiary care hospital in Tamil Nadu reported a prevalence rate of 72% among pregnant women attending antenatal clinics, with moderate anaemia being the most commonly diagnosed category.[16] Likewise, research conducted at a tertiary care hospital in Andhra Pradesh reported an anaemia prevalence of 63%, with the highest occurrence noted during the third trimester.[17]

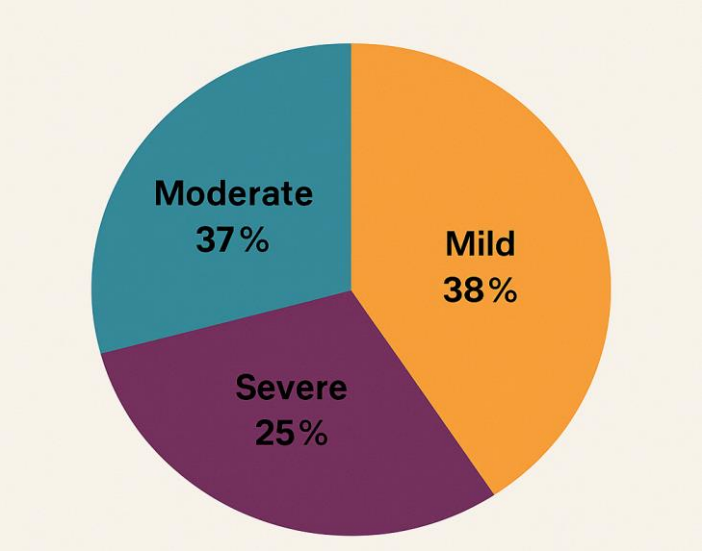


**Figure 3: Distribution of anaemia severity among pregnant women in select hospital studies in India.**

In general, anaemia prevalence tends to be higher in rural hospital settings compared to urban centers. This discrepancy is attributed to lower health-seeking behaviour, poor dietary intake, and lower adherence to antenatal interventions in rural populations [18]. Urban hospitals, while demonstrating slightly lower rates, still report high numbers, reflecting systemic issues such as late registration of pregnancy and inconsistent follow-up.

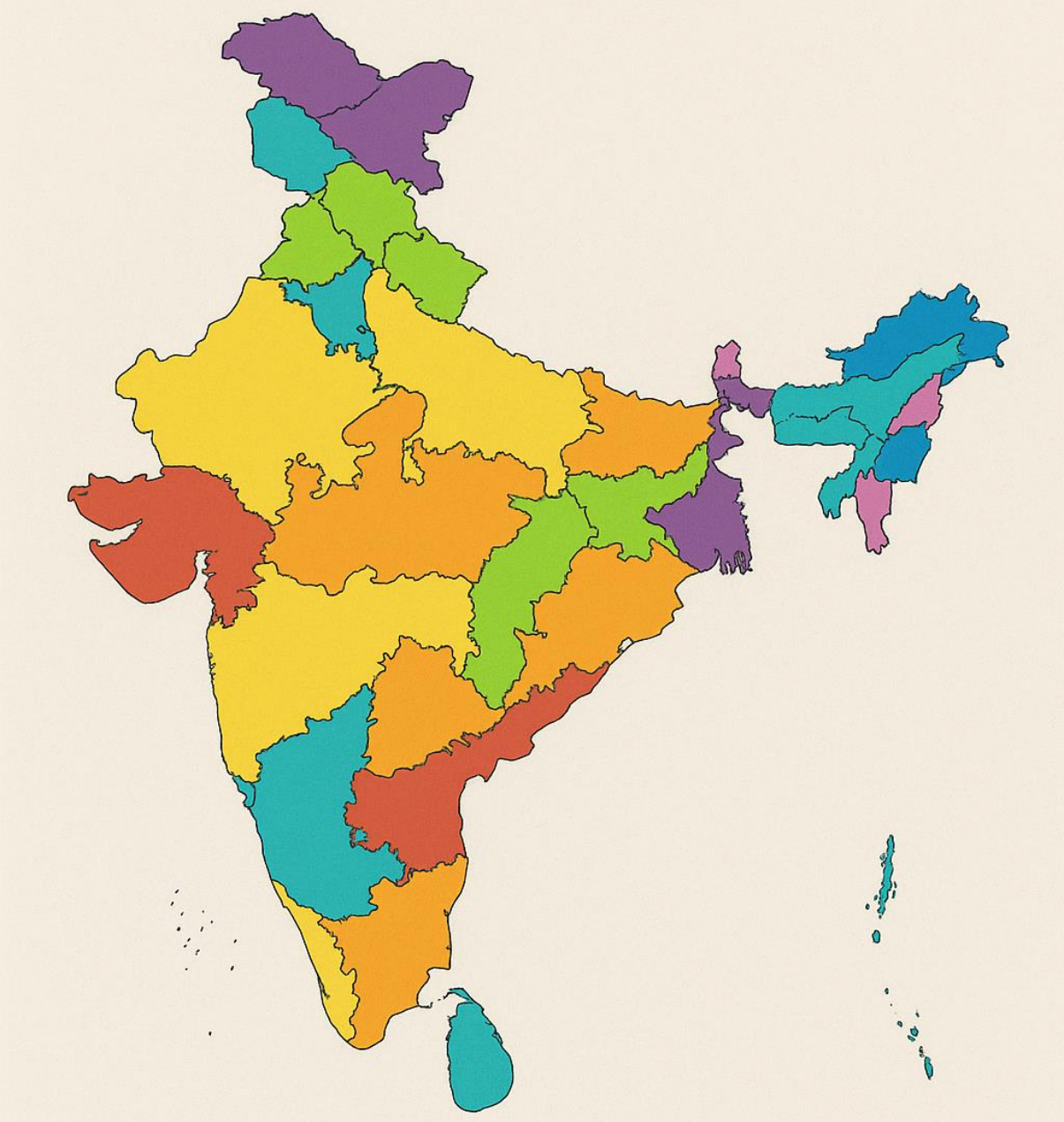

**Figure 4: Geographic distribution of hospital-reported anaemia in pregnancy across Indian states.**

**Figure 4** illustrates the geographic distribution of anaemia prevalence among pregnant women as reported by hospitals across various states in India. The figure employs a vibrant color gradient to visually differentiate the levels of anaemia burden, providing an immediate understanding of regional disparities in maternal health. States with higher reported rates of anaemia are depicted in deeper, warmer colours such as red and orange, while those with lower rates are shown in cooler hues like green and blue.

The data underlying this figure is sourced from hospital records, reflecting clinically diagnosed cases of anaemia in pregnancy. This approach ensures reliability by focusing on medically confirmed cases, though it may underrepresent regions with limited healthcare access. The color-coded map reveals a clear pattern of variation, with states in eastern and central India, including Bihar, Jharkhand, Odisha, and Madhya Pradesh, showing the highest prevalence rates, often exceeding 50%. These states are coloured in deep red, indicating a severe burden of anaemia among pregnant women.

In contrast, southern and western states such as Kerala, Tamil Nadu, and Maharashtra tend to report comparatively lower prevalence rates, typically below 30%. These states are shaded in cooler colours, suggesting better maternal nutritional status and more effective antenatal healthcare programs. The figure also highlights states with moderate anaemia prevalence, falling in the 30–50% range, depicted in shades of yellow and light orange.

Moreover, hospital-based studies provide critical insight into the severity distribution of anaemia, categorizing cases into mild, moderate, and severe forms—which is essential for tailoring clinical interventions and public health policies [19]. Such categorization enables healthcare professionals to identify high-risk patients and optimize the distribution of medical resources. As anaemia remains deeply embedded in India's public health landscape, hospital-based data play a pivotal role in monitoring trends, evaluating the effectiveness of maternal health programs, and guiding targeted interventions at the state and district levels.

Including numerical prevalence data on the map or in an accompanying legend enhances the figure's interpretability. For example, explicitly displaying the percentage of anaemia cases for each state helps stakeholders quickly gauge the severity of the issue in specific regions. Moreover, showing the total number of pregnant women screened in hospitals provides context for the robustness of the data.

This visual representation serves as a critical tool for healthcare policymakers, program planners, and maternal health researchers, enabling them to identify high-risk areas where nutritional supplementation, iron-folic acid therapy, deworming, and antenatal education are urgently needed. Ultimately, the map underscores the persistent and uneven challenge of anaemia in pregnancy in India and highlights the need for region-specific, evidence-based strategies to reduce maternal and foetal morbidity and mortality associated with this condition.

## 3. CLASSIFICATION OF ANAEMIA IN PREGNANCY

Anaemia in pregnancy is not a singular condition but a spectrum of haematological disorders with distinct aetiologies, pathophysiological mechanisms, and clinical implications. A robust classification is essential for implementing targeted interventions and reducing adverse maternal and foetal outcomes. The classification of anaemia in pregnancy can be done based on aetiology and severity, which aids clinicians in risk stratification and therapeutic decision-making.

### 3.1 Classification Based on Aetiology

**Table 3: Aetiological Classification of Anaemia in Pregnancy.**

| S.No. | Type of Anaemia | Key Features | Diagnostic Indicators | Clinical Relevance |
|---|---|---|---|---|
| 1 | Iron Deficiency Anaemia (IDA) | Most common (≈70% cases); due to low intake, poor absorption, increased demand[20,21] | Low serum ferritin (<15 ng/mL), microcytic hypochromic RBCs | Fatigue, pallor, breathlessness; higher in low socioeconomic strata |
| 2 | Megaloblastic Anaemia | Due to folate or vitamin B12 deficiency; common in vegetarian populations[22,23] | Macrocytic RBCs, low serum B12 or folate, glossitis | Risk of neural tube defects, peripheral neuropathy, cognitive symptoms in mother |
| 3 | Hemolytic Anaemia | Includes thalassemia and sickle cell disease; genetic in origin[24–27] | Abnormal Hb electrophoresis, haemolysis signs | Risk of preeclampsia, IUGR, preterm delivery; requires prenatal screening in endemic regions |
| 4 | Anaemia of Chronic Disease (ACD) | Due to chronic infections (TB, HIV), autoimmune diseases, and malignancies[28] | Normocytic normochromic anaemia, elevated hepcidin | Complex diagnosis; often coexists with IDA; impaired iron utilization despite normal stores |

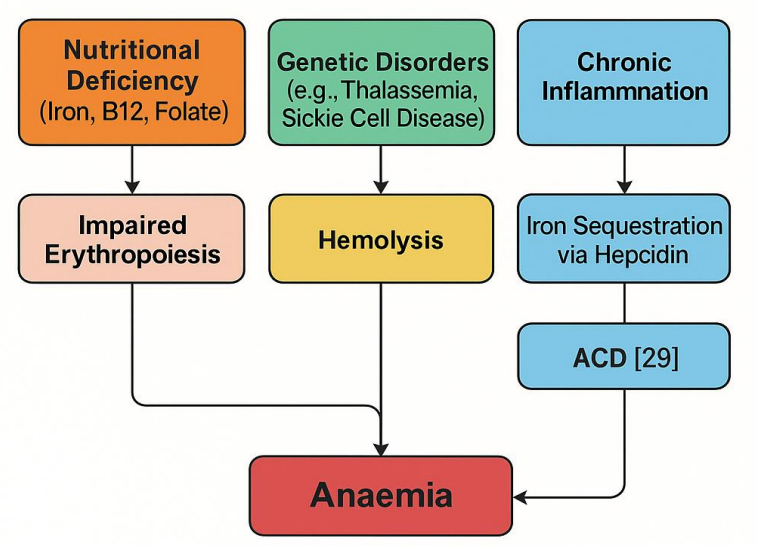


**Figure 5: Mechanisms of Anaemia in Pregnancy (Flow Diagram)**

- Nutritional Deficiency (Iron, B12, Folate) → Impaired Erythropoiesis
- Genetic Disorders (e.g., Thalassemia, Sickle Cell Disease) → Hemolysis
- Chronic Inflammation → Iron Sequestration via Hepcidin → ACD[29]

### 3.2 Classification Based on Severity (WHO Criteria)

Severity assessment based on haemoglobin concentration is crucial for clinical management. The WHO categorization provides a standardized approach.[6]

**Table 4: WHO Severity Classification of Anaemia in Pregnancy.**

| S.No. | Severity | Haemoglobin (g/dL) | Clinical Features | Management Strategy |
|---|---|---|---|---|
| 1 | Mild | 10.0–10.9 | Often asymptomatic | Oral iron supplementation, dietary counselling |
| 2 | Moderate | 7.0–9.9 | Fatigue, breathlessness, reduced functional capacity | Iron therapy, nutritional intervention, and monitoring |
| 3 | Severe | <7.0 | Risk of cardiac failure, preterm labour, and low birth weight | Parenteral iron or transfusion, and intensive care if needed |

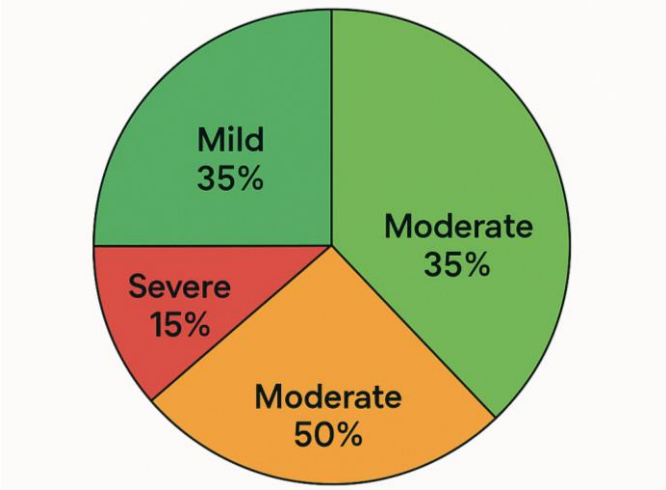


**Figure 6: Pie Chart Showing Proportion of Anaemia Severity.**

**Discussion and Implications:** Iron deficiency anaemia (IDA) remains the predominant form due to nutritional deficits exacerbated by pregnancy's increased physiological demands.[21] The condition is particularly widespread in low- and middle-income nations. Implementing preventive measures like iron-folic acid supplementation and food fortification continues to be essential.

Megaloblastic anaemia underscores the need for broader micronutrient coverage in antenatal care, especially in folate-deficient regions.[22,23] Moreover, hemoglobinopathies like thalassemia and sickle cell disease require early identification and genetic counselling.[24–27]

The coexistence of ACD with IDA in settings of chronic infection or inflammation complicates treatment, emphasizing the need for biochemical profiling (e.g., ferritin, hepcidin levels) to guide therapy.[28]

Accurate classification based on both aetiology and severity allows for effective clinical prioritization. Severe anaemia warrants urgent management due to its association with maternal morbidity, perinatal complications, and mortality.[29]

## 4. RISK FACTORS FOR ANAEMIA IN PREGNANCY

Anaemia during pregnancy is a complex, multifactorial condition influenced by an interplay of biological, social, and environmental factors. Recognizing these risk factors is vital to developing effective approaches for prevention and treatment. This chapter elaborates on the primary contributors to anaemia in pregnancy and presents supporting visuals and data.

### 4.1 Nutritional Deficiencies

Nutritional anaemia arises from insufficient intake or absorption of key hematopoietic nutrients—primarily iron, folate, and vitamin B12. Poor dietary diversity and low consumption of bioavailable iron-rich foods are prevalent among pregnant women in low-resource settings. Iron deficiency accounts for approximately 50% of anaemia cases in pregnancy globally.[30]

**Table 5: Common Nutritional Causes of Anaemia in Pregnancy.**

| S.No. | Nutrient | Role in Erythropoiesis | Deficiency Effects |
|---|---|---|---|
| 1 | Iron | Hemoglobin synthesis | Microcytic hypochromic anaemia |
| 2 | Folate | DNA synthesis in erythroid precursors | Megaloblastic anaemia |
| 3 | Vitamin B12 | Maturation of red blood cells | Neurological symptoms + macrocytosis |

### 4.2 Age and Parity

**Teenage Pregnancy:** Adolescents are at elevated risk due to competing physiological demands—growth and fetal development. Their iron stores are often marginal at conception, exacerbating anaemia risk.[31,32]

**Short Interpregnancy Intervals:** Women with less than 18 months between pregnancies show significantly higher prevalence of anaemia. The time is insufficient for replenishment of iron stores.[33,34]

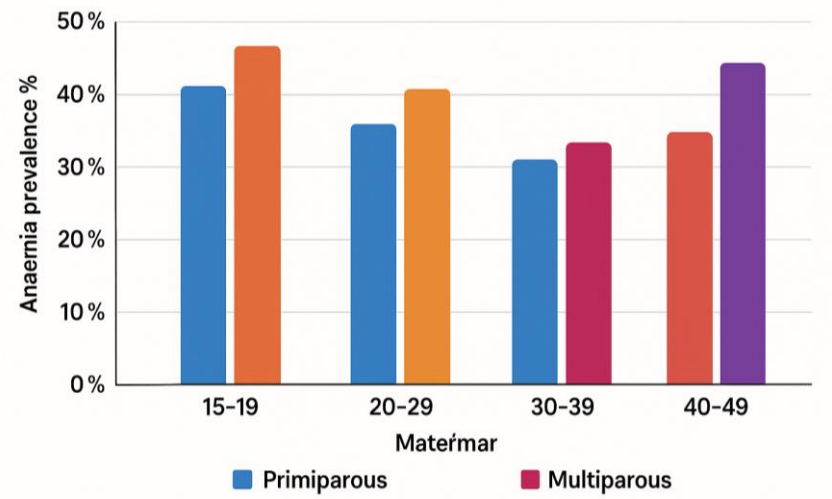


**Figure 7: Anaemia Risk by Maternal Age and Parity.**

A bar chart showing anaemia prevalence across age groups and parity levels.

### 4.3 Infections and Parasitic Infestations

Infectious diseases significantly contribute to anaemia by either causing blood loss, hemolysis, or interfering with iron metabolism.

- **Hookworm Infestation:** Leads to chronic blood loss from the gastrointestinal tract.[35]
- **Malaria:** Causes intravascular hemolysis and splenic sequestration of erythrocytes.[36]
- **HIV/AIDS:** Induces bone marrow suppression and chronic inflammation.[37]

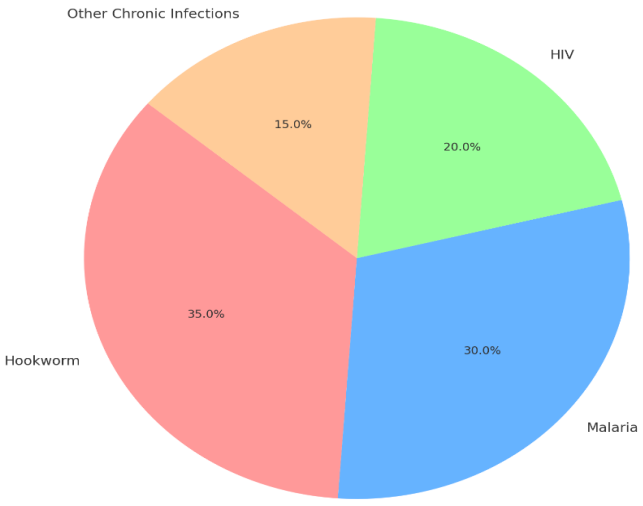


**Figure 8: Contribution of Common Infections to Anaemia in Endemic Regions.**

Pie chart with segments for hookworm, malaria, HIV, other chronic infections.

### 4.4 Antenatal Care and Supplementation

Access to quality antenatal care (ANC) significantly impacts early diagnosis and management of anaemia. Inadequate antenatal care visits result in missed chances for screening, delayed start of iron-folic acid supplementation, and overlooked coexisting medical conditions.[38]

**Table 6: Impact of ANC Visits on Anaemia Prevalence.**

| S.No. | ANC Visit Frequency | Anaemia Prevalence (%) |
|---|---|---|
| 1 | <2 visits | 72% |
| 2 | 2–3 visits | 55% |
| 3 | ≥4 visits | 38% |

### 4.5 Socioeconomic and Environmental Factors

Poor economic status, food insecurity, lack of education, and limited access to health facilities are indirect but powerful determinants of maternal anaemia. Women in rural and marginalized communities face greater challenges in accessing iron-rich food and medical care.[5]

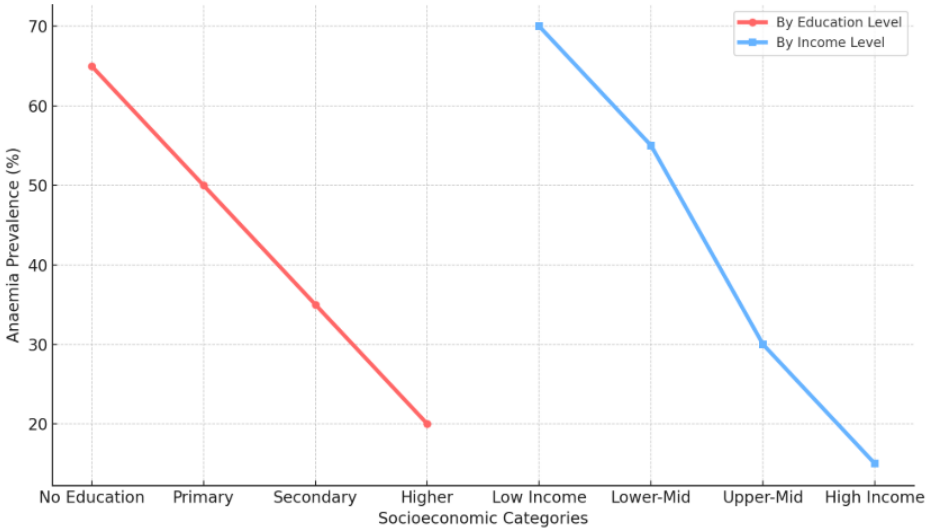


**Figure 9: Line graph showing inverse relationship between income/education levels and anaemia prevalence.**

### 4.6 Genetic and Hematologic Disorders

Genetic conditions like thalassemia, sickle cell anaemia, and other hemoglobinopathies complicate pregnancy anaemia by reducing hemoglobin synthesis or increasing hemolysis.[40]

- Thalassemia trait is common in parts of India and may coexist with nutritional anaemia.

- Sickle cell disease increases risk for vaso-occlusive crises and severe anaemia.

**Table 7: Risk Factors for Anaemia in Pregnancy.**

| S.No. | Risk Factor | Mechanism of Action | Preventive Measures |
|---|---|---|---|
| 1 | Nutritional Deficiencies | Impaired erythropoiesis | Iron-folate-B12 supplementation |
| 2 | Teenage Pregnancy | Increased demand + low reserves | Education, contraception, early screening |
| 3 | Short Interpregnancy Interval | Incomplete iron recovery | Family planning, postpartum supplementation |
| 4 | Parasitic Infections | Blood loss, hemolysis | Deworming, malaria prophylaxis |
| 5 | Poor Antenatal Care | Missed screening/treatment opportunities | Strengthen ANC services |
| 6 | Low Socioeconomic Status | Food insecurity, poor healthcare access | Nutritional support, free IFA programs |
| 7 | Hemoglobinopathies | Ineffective erythropoiesis, hemolysis | Genetic screening, high-risk management |

**5. Clinical Presentation**

Anaemia during pregnancy presents with a wide spectrum of clinical manifestations, which vary based on the severity and duration of iron deficiency and the individual's physiological reserve. **Mild anaemia** is frequently asymptomatic, or may manifest subtly as generalized **fatigue**, **lethargy**, and **reduced exercise tolerance**, all attributable to impaired oxygen delivery to peripheral tissues.[41] A classic and easily observable sign is **pallor**, particularly of the **conjunctivae**, **palms**, and **oral mucosa.**[42]

As anaemia progresses, **cardiovascular compensatory mechanisms** attempt to maintain oxygenation by increasing cardiac output. This often results in **exertional dyspnoea**, **palpitations**, and **tachycardia.**[43] A distinctive behavioral symptom linked specifically with **iron deficiency anaemia** is **pica**—the compulsive consumption of non-nutritive substances such as **ice, clay, or soil.**[44]

In moderate to severe cases, **neurological symptoms** including **headache**, **dizziness**, and **faintness** emerge, reflecting the impact of **cerebral hypoxia.**[45] **Severe anaemia** (Hb <7 g/dL) can precipitate **high-output cardiac failure**, increasing the risk of **cardiac decompensation** in the later stages of pregnancy.[46]

Anaemia not only affects maternal well-being but is also implicated in numerous **adverse obstetric outcomes**, such as:

- **Preterm labor** and **low birth weight** infants due to placental insufficiency,
- **Increased susceptibility to infections** from impaired cell-mediated immunity[47–49], and
- **Postpartum hemorrhage (PPH)**, wherein reduced hemoglobin reserve compromises the mother's ability to withstand obstetric blood loss.[50]

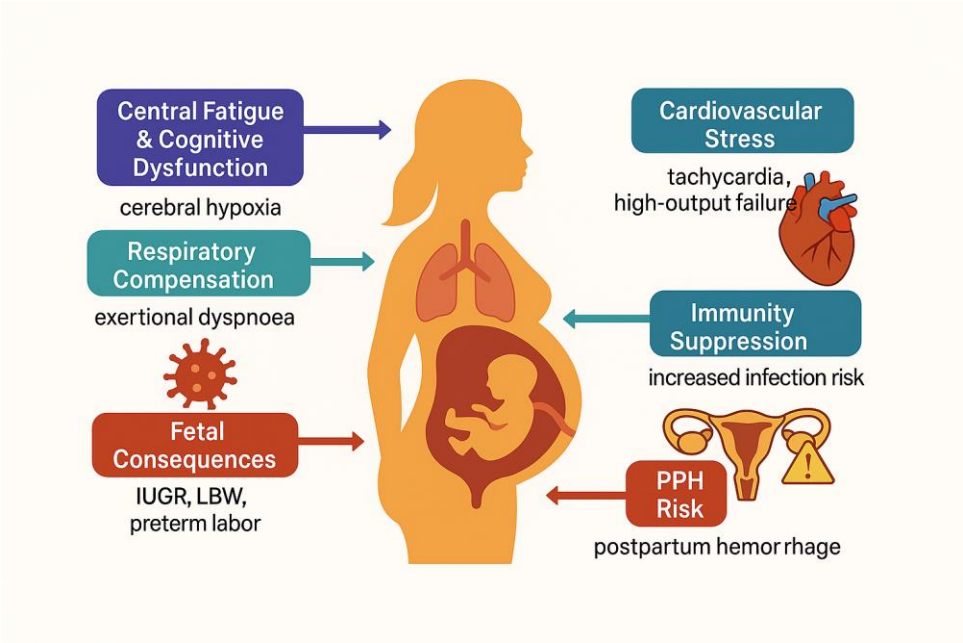


**Figure 10: Clinical Manifestations and Pathophysiological Impact of Anaemia During Pregnancy.**

## 6. Maternal and Fetal Outcomes

**6.1 Maternal Outcomes: Severe** anaemia during pregnancy significantly increases the risk of life-threatening maternal complications due to hypoxia-induced organ dysfunction, hemodynamic instability, and impaired immune response. Studies have shown that women with severe anaemia are **2.4 to 6.9 times more likely to develop preeclampsia**, **3.1 to 5.8 times more likely to experience postpartum haemorrhage (PPH)**, and **2.1 to 4.5 times more susceptible to sepsis**. Additionally, **maternal mortality increases by 10–20%** in these cases.[6,14]

**Table 8: Relative Increase in Maternal Complications and Mortality Risk Due to Severe Anaemia in Pregnancy.**

| S.No. | Outcome | Increased Risk in Severe Anaemia |
|---|---|---|
| 1 | Preeclampsia | 2.4–6.9 times higher |
| 2 | Postpartum Haemorrhage | 3.1–5.8 times higher |
| 3 | Sepsis | 2.1–4.5 times higher |
| 4 | Maternal Mortality | Increased by 10–20% |

**Interpretation:** Severe anaemia compromises oxygen delivery and immune competence, predisposing pregnant women to hypertensive disorders, infections, and hemorrhagic complications, which can culminate in increased maternal mortality if not adequately managed.[53,48]

**6.2 Neonatal Outcomes:** Fetal development is particularly sensitive to maternal haemoglobin levels. Hypoxia and placental insufficiency associated with anaemia can lead to **low birth weight in 25–40%** of cases, **preterm birth in 15–30%**, **intrauterine growth restriction (IUGR) in 12–25%**, and **stillbirth in 5–10%** of pregnancies.[47,56]

**Table 9: Prevalence Rates of Neonatal Complications Associated with Maternal Anaemia.**

| S.No. | Outcome | Prevalence among Anaemic Mothers |
|---|---|---|
| 1 | Low Birth Weight (LBW) | 25–40% |
| 2 | Preterm Birth | 15–30% |
| 3 | Intrauterine Growth Restriction (IUGR) | 12–25% |
| 4 | Stillbirth | 5–10% |

**Interpretation:** Anaemia reduces uteroplacental perfusion and oxygenation, impairing intrauterine growth and increasing the likelihood of preterm delivery, LBW, and even fetal demise in severe cases.[57,58]

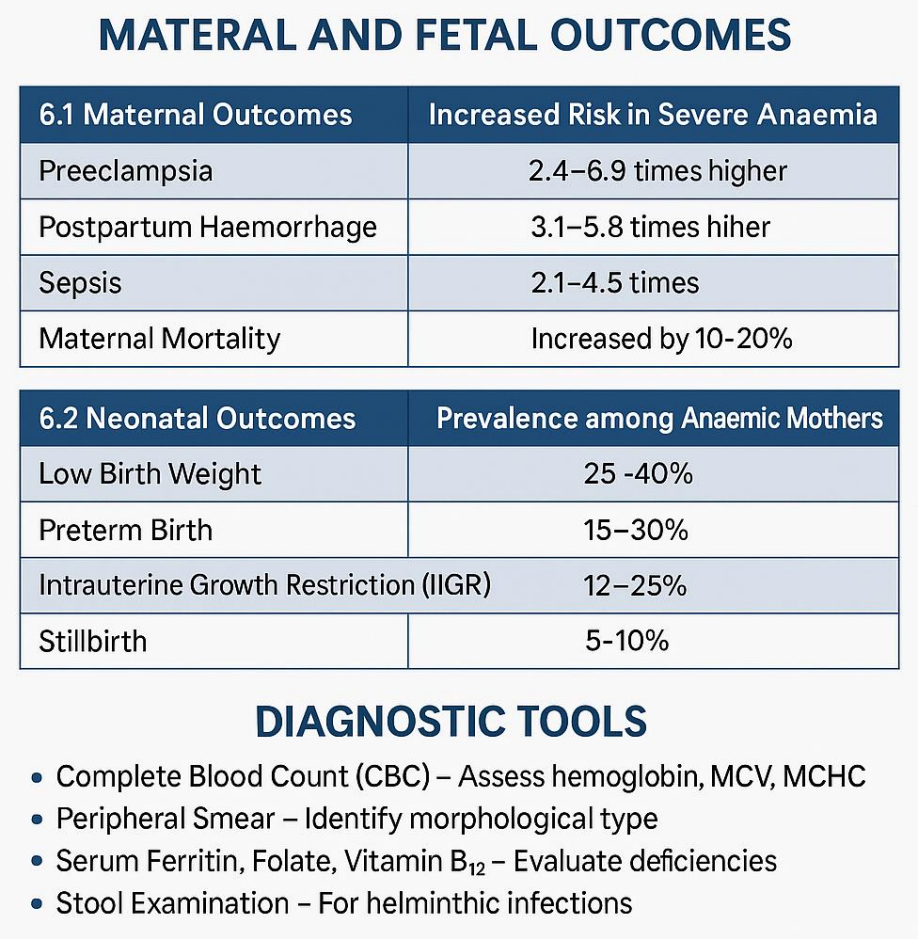


**Figure 11: Maternal and Neonatal Risks and Diagnostic Tools in Anaemia During Pregnancy.**

This infographic visually presents the increased risks of maternal complications such as preeclampsia, postpartum haemorrhage, and sepsis due to severe anaemia, along with the prevalence of neonatal complications. It also summarizes key diagnostic tools recommended in clinical practice.

### 7. Diagnostic Tools

Early diagnosis and classification of anaemia are essential for timely intervention. A multi-modal diagnostic approach is recommended and supported by WHO and national guidelines[42,60]:

- **Complete Blood Count (CBC):** Evaluates haemoglobin concentration, mean corpuscular volume (MCV), and mean corpuscular haemoglobin concentration (MCHC) to classify anaemia severity.
- **Peripheral Blood Smear:** Differentiates between microcytic, macrocytic, and normocytic anaemia based on red cell morphology.[35]

- **Serum Ferritin, Folate, and Vitamin B12 Levels:** Biochemical markers used to detect nutritional deficiencies contributing to anaemia.[62]
- **Stool Examination:** Identifies helminthic infestations (e.g., hookworm), which contribute to chronic blood loss and iron depletion.[63]

## 8. Management Strategies

### 8.1 Preventive Approaches

Preventing anaemia during pregnancy is critical to reduce adverse maternal and fetal outcomes. The **World Health Organization recommends** a daily supplementation of **60 mg elemental iron and 400 µg folic acid** throughout pregnancy to prevent iron deficiency anaemia.[64] Routine **deworming with Albendazole (400 mg)** after the second trimester helps eliminate parasitic causes of chronic blood loss. Furthermore, **dietary counselling** plays an essential role in encouraging the intake of **iron-rich foods** such as green leafy vegetables, legumes, and animal products to improve nutritional status.

### 8.2 Therapeutic Interventions

Treatment depends on the severity and tolerance to iron preparations:

- **Oral iron therapy** (e.g., ferrous sulfate) remains the first-line treatment for mild to moderate anaemia.
- **Intravenous iron formulations** such as **iron sucrose or ferric carboxymaltose** are indicated in cases of oral iron intolerance, malabsorption, or when rapid correction is required.
- **Blood transfusion** is reserved for emergencies, especially when **hemoglobin levels drop below 7 g/dL** and the patient is symptomatic or haemodynamically unstable.

## 9. Hospital-Based Case Studies

A retrospective observational study conducted at a **rural tertiary care center in Telangana** by **Rajani et al. (2024)** reported a **68% prevalence of anaemia among pregnant women**, highlighting the gravity of this issue in semi-urban and rural populations. The findings included:

- Moderate anaemia was the predominant form, accounting for 49% of the cases..
- Maternal complications included postpartum haemorrhage (12.4%) and preeclampsia (10.2%).
- Among neonatal outcomes, low birth weight was observed in 28.7% of cases, while preterm births accounted for 18.6%

These data underscore the direct correlation between maternal anaemia and poor obstetric and neonatal outcomes.

## 10. Policy and Public Health Implications

India's **National Iron+ Initiative** aims to achieve universal iron and folic acid (IFA) supplementation across different life stages, especially during pregnancy . The **RMNCH+A strategy** (Reproductive, Maternal, Newborn, Child and Adolescent Health) integrates anaemia screening and treatment under comprehensive antenatal care services.

To improve maternal health indicators, **community education campaigns** must emphasize dietary modifications, the importance of IFA compliance, and regular antenatal check-ups. Greater awareness among rural populations is key to bridging gaps in prevention and early detection.

## 11. Gaps in Current Research

Despite national programs, significant research gaps persist:

- The absence of extensive, long-term hospital-based data limits the ability to conduct more comprehensive epidemiological studies.
- **Limited comparative studies** exist on the efficacy and acceptability of **oral versus intravenous iron** therapy, particularly in rural populations .
- There is a **lack of integration** between **community-based health records** and **hospital documentation**, making it difficult to track patient compliance and outcomes across care levels.

## 12. CONCLUSION

Anaemia in pregnancy remains a **major public health challenge** with far-reaching **maternal and neonatal complications**. Hospital-based data provide essential insights into its **prevalence, types, and clinical impact**, guiding tailored preventive and therapeutic strategies. Strengthening **antenatal service delivery**, enhancing **diagnostic infrastructure**, and **ensuring adherence** to national guidelines can significantly mitigate the burden of anaemia and improve pregnancy outcomes.

## REFERENCES

1. World Health Organization. Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity. Geneva: WHO, 2011.

2. World Health Organization. The Global Prevalence of Anaemia in 2011. Geneva: WHO, 2021.
3. Toteja GS, Singh P, Dhillon BS, Saxena BN. Prevalence of anaemia among pregnant women and adolescent girls in 16 districts of India. Food Nutr Bull., 2006; 27(4): 311–5.
4. International Institute for Population Sciences (IIPS) and ICF. National Family Health Survey (NFHS-5), 2019–21: India. Mumbai: IIPS, 2021.
5. Balarajan Y, Ramakrishnan U, Özaltin E, Shankar AH, Subramanian SV. Anaemia in low-income and middle-income countries. Lancet, 2011; 378(9809): 2123–35.
6. Kalaivani K. Prevalence and consequences of anaemia in pregnancy. Indian J Med Res., 2009; 130(5): 627–33.
7. Kaur K. Anaemia 'a silent killer' among women in India: Present scenario. Eur J Zool Res., 2018; 7(2): 32–6.
8. DeMaeyer EM, Adiels-Tegman M. The prevalence of anaemia in the world. World Health Stat Q., 1985; 38(3): 302–16.
9. Pasricha SR, Drakesmith H, Black J, Hipgrave D, Biggs BA. Control of iron deficiency anemia in low- and middle-income countries. Blood, 2013; 121(14): 2607–17.
10. Ministry of Health and Family Welfare, Government of India. Anemia Mukt Bharat Dashboard. [Internet]. 2021. Available from: https://anemiamuktbharat.info
11. Global Nutrition Report. 2021 Global Nutrition Report: The State of Global Nutrition. Development Initiatives, 2021.
12. World Health Organization. Worldwide prevalence of anaemia 1993–2005: WHO Global Database on Anaemia. Geneva: WHO, 2008.
13. Stevens GA, Finucane MM, De-Regil LM, et al. Global, regional, and national trends in haemoglobin concentration and prevalence of total and severe anaemia in children and pregnant and non-pregnant women. Lancet Glob Health, 2013; 1(1): e16–25.
14. Black RE, Victoria CG, Walker SP, et al. Maternal and child undernutrition and overweight in low-income and middle-income countries. Lancet, 2013; 382(9890): 427–451.
15. Ghosh S. Exploring socioeconomic vulnerability of anaemia among women in India. Health, 2017; 9(4): 502–517.
16. Kumar D, Rajalakshmi R, Dinesh S. Prevalence and classification of anaemia among antenatal women in a tertiary care hospital in Tamil Nadu. Int J Reprod Contracept Obstet Gynecol, 2020; 9(5): 2000–2005.

17. Reddy KN, Sudha R, Sharma P. A hospital-based cross-sectional study on anaemia among pregnant women in Andhra Pradesh. J Clin Diagn Res., 2019; 13(2): QC04–QC07.
18. Singh P, Toteja GS. Micronutrient profile of Indian population. Indian J Med Res., 2020; 151(5): 483–495.
19. Kalaivani K, Ramachandran P. Time trends in prevalence of anaemia in pregnancy. Indian J Med Res., 2018; 147(3): 268–277.
20. Pavord S, Myers B, Robinson S, et al. UK guidelines on the management of iron deficiency in pregnancy. Br J Haematol, 2012; 156(5): 588–600.
21. WHO. Iron deficiency anaemia: assessment, prevention and control – A guide for programme managers. Geneva: World Health Organization, 2001.
22. Allen LH. Causes of vitamin B12 and folate deficiency. Food Nutr Bull., 2008; 29(2): S20–S34.
23. Kaur J, Kaur K. Megaloblastic anaemia in pregnancy: a neglected problem. Int J Reprod Contracept Obstet Gynecol, 2018; 7(8): 3369–3373.
24. Nair M, Choudhury MK, Choudhury SS, et al. Association between maternal anaemia and pregnancy outcomes: a cohort study in Assam, India. BMJ Glob Health, 2016; 1(1): e000026.
25. McLean E, Cogswell M, Egli I, et al. Worldwide prevalence of anaemia, WHO Vitamin and Mineral Nutrition Information System, 1993–2005. Public Health Nutr., 2009; 12(4): 444–454.
26. Weatherall DJ. The inherited diseases of hemoglobin are an emerging global health burden. Blood. 2010; 115(22): 4331–4336.
27. Modell B, Darlison M. Global epidemiology of haemoglobin disorders and derived service indicators. Bull World Health Organ, 2008; 86(6): 480–487.
28. Weiss G, Goodnough LT. Anemia of chronic disease. N Engl J Med., 2005; 352(10): 1011–1023.
29. WHO. Nutritional anaemias: Tools for effective prevention and control. Geneva: World Health Organization, 2017.
30. Stevens GA et al. Global, regional, and national trends in haemoglobin concentration and prevalence of total and severe anaemia in children and pregnant women. Lancet Glob Health, 2016.
31. UNICEF. Adolescent anaemia: Global burden and determinants.
32. Galloway R. Anaemia prevention and control: What works? Geneva: World Bank, 2003.

33. Conde-Agudelo A et al. Birth spacing and maternal health: A systematic review. Am J Obstet Gynecol, 2006.
34. Brooker S et al. Hookworm-related anaemia among pregnant women: a systematic review. PLoS Negl Trop Dis., 2008.
35. Hotez PJ. Control of neglected tropical diseases. N Engl J Med., 2007.
36. Van den Broek NR. Anaemia and infection in pregnancy: Reducing maternal risk. Br J Haematol, 2008.
37. Ministry of Health and Family Welfare, Government of India. Guidelines for ANC.
38. WHO. Guidelines on haemoglobin thresholds for diagnosis of anaemia. Geneva, 2021.
39. Peek ME. Rethinking Anemia Assessment. J Clin Med., 2020; 9(2): 502.
40. Tolentino K, Friedman JF. An update on anemia in less developed countries. Am J Trop Med Hyg., 2007; 77(1): 44–51.
41. Dallman PR. Biochemical basis for the manifestations of iron deficiency. Annu Rev Nutr., 1986; 6: 13–40.
42. Rose AJ, O'Connell KA. Pica in pregnancy: A review of the literature and implications for clinical practice. J Perinat Neonatal Nurs., 2020; 34(3): 282–289.
43. Haas JD, Brownlie T. Iron deficiency and reduced work capacity: A critical review. J Nutr., 2001; 131(2S-2): 676S–690S.
44. Friedman JF, Kauh T, McGarvey ST. Anaemia and heart failure in pregnancy: Pathophysiology and clinical implications. Curr Opin Obstet Gynecol, 2011; 23(6): 420–424.
45. Allen LH. Pregnancy and iron deficiency: unresolved issues. Nutr Rev., 1997; 55(4): 91–101.
46. Young MF, Oaks BM, Tandon S, et al. Maternal anemia and risk of adverse birth and health outcomes in LMICs: Systematic review and meta-analysis. Am J Clin Nutr., 2019; 110(6): 1406–1417.
47. Katona P, Katona-Apte J. The interaction between nutrition and infection. Clin Infect Dis., 2008; 46(10): 1582–1588.
48. McClure EM, Goldenberg RL. Anemia and postpartum hemorrhage. Int J Gynaecol Obstet, 2014; 124(1): 93–94.
49. Peña-Rosas JP, De-Regil LM, Garcia-Casal MN, Dowswell T. Daily oral iron supplementation during pregnancy. Cochrane Database Syst Rev., 2015; 7: CD004736.

50. Rahman MM, Abe SK, Kanda M, Narita S, Rahman MS, Bilano V, et al. Maternal anemia and risk of adverse birth and health outcomes in low- and middle-income countries: systematic review and meta-analysis. Am J Clin Nutr., 2016; 103(2): 495–504.
51. Ministry of Health and Family Welfare (MoHFW), Government of India. Guidelines for Control of Iron Deficiency Anaemia, 2013.
52. Milman N. Iron deficiency and anemia in pregnancy: Modern aspects of diagnosis and therapy. Acta Obstet Gynecol Scand, 2011; 90(12): 144–149.
53. World Health Organization. Guideline: Daily Iron and Folic Acid Supplementation in Pregnant Women. Geneva: WHO, 2012.
54. WHO. Deworming in Pregnancy: WHO Recommendations. Geneva: World Health Organization, 2014.
55. Allen LH. Biological mechanisms that might underlie iron's effects on fetal growth and preterm birth. J Nutr., 2001; 131(2S–2): 581S–589S.
56. Breymann C. The use of iron sucrose complex for anemia in pregnancy. Women's Health (Lond), 2005; 1(3): 333–342.
57. Pavord S, Daru J, Prasannan N, et al. UK guidelines on the management of iron deficiency in pregnancy. Br J Haematol, 2020; 188(6): 819–830.
58. Rajani K, Shireesha K, Purushothaman K. Hospital-based assessment of anaemia types and maternal outcomes in pregnancy: a rural tertiary care experience. World J Pharm Res., 2025; 14(2): 44–59.
59. Ministry of Health and Family Welfare. National Iron+ Initiative: Guidelines for Control of Iron Deficiency Anaemia. New Delhi: Government of India, 2013.
60. Ministry of Health and Family Welfare. RMNCH+A Strategy: Government of India, 2013.
61. Vir SC. Public health nutrition in developing countries. New Delhi: Woodhead Publishing India, 2011.
62. Bhandal N, Russell R. Intravenous versus oral iron therapy for postpartum anaemia. BJOG, 2006; 113(11): 1248–1251.
63. Kalaivani K, Ramachandran P. Time trends in prevalence of anaemia in pregnancy. Indian J Med Res., 2018; 147(3): 268–277.