RESEARCH PAPER

Maternal Anaemia and the Risk of Preterm Birth and Low Birth Weight: A Review of Evidence

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ABSTRACT

Background:
Maternal anaemia remains a widespread nutritional and public health problem during pregnancy, particularly in low- and middle-income countries. It is characterized by reduced haemoglobin concentration, which compromises oxygen delivery to maternal and fetal tissues. Numerous studies have identified maternal anaemia as an important contributor to adverse pregnancy outcomes, including preterm birth and low birth weight (LBW).

Objective:
This review aimed to examine the available evidence regarding the relationship between maternal anaemia and the occurrence of preterm birth and low birth weight among newborns.

Methods:
A narrative literature review was undertaken using published evidence from systematic reviews, meta-analyses, cohort studies, case-control studies, cross-sectional studies, and observational research. Relevant studies investigating the effects of maternal anaemia on pregnancy and neonatal outcomes were identified, reviewed, and synthesized.

Results:
The reviewed literature consistently indicated that maternal anaemia is associated with an elevated risk of adverse neonatal outcomes. Women with anaemia were found to have a greater likelihood of delivering preterm infants and infants with low birth weight compared with non-anaemic women. Evidence further suggested that the risk increased with the severity of anaemia, with moderate and severe forms showing the strongest associations. In addition, maternal anaemia was linked to other complications such as neonatal mortality, neonatal intensive care unit admissions, small-for-gestational-age births, and neonatal anaemia.

Conclusion:
Maternal anaemia is a significant risk factor for preterm birth and low birth weight and continues to pose a challenge to maternal and child health globally. Early detection, adequate nutritional support, routine iron and folic acid supplementation, and strengthened antenatal care services are essential measures to reduce anaemia-related complications and improve pregnancy outcomes.

Keywords: Maternal anaemia, pregnancy outcomes, preterm birth, low birth weight, neonatal health, iron deficiency

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1.INTRODUCTION

Maternal anaemia is one of the most common nutritional disorders affecting pregnant women worldwide and continues to be a major public health challenge, particularly in low- and middle-income countries. According to DeMaeyer and Adiels-Tegman (1985), approximately 42% of pregnant women globally are affected by anaemia. Iron deficiency remains the leading cause of maternal anemia, although folate deficiency, vitamin B12 deficiency, parasitic infections, malaria, chronic diseases, and inadequate dietary intake also contribute significantly to its occurrence.

Pregnancy is characterized by increased nutritional and physiological demands to support maternal health, placental development, and fetal growth. When these demands are not adequately met, maternal hemoglobin levels decline, resulting in anemia. Reduced oxygen-carrying capacity impairs placental oxygenation and nutrient transport, which may adversely affect fetal growth and gestational duration. Consequently, maternal anemia has been linked to numerous adverse maternal and neonatal outcomes, including preterm birth, low birth weight (LBW), small-for-gestational-age infants, neonatal anemia, perinatal mortality, and maternal complications.

Maternal anaemia was defined as hemoglobin levels below 11 g/dL, and infants were categorized as low birth weight (<2500 g) or insufficient weight (2500–2999 g). One of the studies revealed that maternal anaemia significantly increased the risk of low or insufficient birth weight. Approximately 25% of the women had been anaemic, and among them, 37% of infants were born with

low or insufficient birth weight compared to 27% among non-anaemic mothers (JET et al., 2019).

Several large-scale studies have demonstrated the magnitude of this problem. Figueiredo et al. (2018), in a systematic review involving 71 studies and a meta-analysis of 68 studies, confirmed that maternal anemia significantly increased the risk of low birth weight. Similarly, Adhimukhti et al. (2023), in a meta-analysis of 17 cohort studies, reported that maternal anemia increased the risk of low birth weight by approximately 35%. Mizanur et al. (2016) found that maternal anemia contributed to 12% of low birth weight cases and 19% of preterm births in low- and middle-income countries.

Evidence from cohort studies further supports this association. Yi et al. (2013), in a retrospective cohort study involving 70,895 Korean women, demonstrated that moderate-to-severe maternal anemia significantly increased the risk of preterm birth, low birth weight, and small-for-gestational-age infants. Similarly, a large Chinese cohort study involving 160,700 singleton births reported that maternal anemia during early pregnancy increased the risk of preterm premature rupture of membranes and other adverse birth outcomes (Qiaoyi Z., 2009). Chen et al. (2024) also found that increasing severity of anemia during early pregnancy was associated with progressively higher risks of preterm birth, low birth weight, and small-for-gestational-age infants.

The relationship between maternal anemia and preterm birth has been consistently documented across different populations. Rahmati et al. (2020), through a systematic review and meta-analysis involving more than 932,000 women, found that maternal anemia increased the risk of preterm birth by 56%, particularly when anemia occurred during the first trimester. Khezri et al. (2023) reported that anemic women were nearly three times more likely to experience preterm birth than non-anemic women. Similarly, Kumari et al. (2019) observed that severe anemia increased the odds of preterm birth nearly fivefold among pregnant women in India.

Maternal anemia has also been associated with low birth weight in several studies. Mustansir et al. (2021) found that 28.9% of infants born to anemic mothers had low birth weight compared with 17.8% among non-anemic mothers. A Brazilian prospective cohort study reported a 38% higher risk of low or insufficient birth weight among infants born to anemic women. Garshabi et al. (2006), Kidanto et al. (2009), Rani et al. (2017), and Bhaware et al. (2026) similarly reported significantly increased rates of low birth weight among mothers with moderate and severe anemia.

The severity of maternal anemia appears to play a crucial role in determining pregnancy outcomes. Li et al. (2022), in a cohort of 138,556 pregnant women, demonstrated that the incidence of severe maternal outcomes increased dramatically with worsening anemia severity, reaching 11.3% among women with severe anemia. Smith C et al. (2019), in a study involving over 515,000 women, reported that even mild anemia was associated with adverse maternal and neonatal outcomes, while risks increased substantially among women with moderate and severe anemia.

Beyond preterm birth and low birth weight, maternal anemia has been linked to numerous additional complications. Wang et al. (2025) identified significant associations between maternal anemia and postpartum hemorrhage, premature rupture of membranes, gestational hypertension, cesarean section, and neonatal asphyxia. Smith C et al. (2019) reported higher rates of preeclampsia, placenta previa, blood transfusion, neonatal mortality, and perinatal mortality among anemic mothers. Zhao et al. (2022) further demonstrated a significant association between maternal anemia and neonatal anemia, highlighting the intergenerational impact of poor maternal iron status.

The prevalence of maternal anemia varies considerably across regions and populations. Kabir et al. (2022) reported a prevalence of 44% in Bangladesh, while Kumari et al. (2019) documented a prevalence of 78.45% in Jharkhand, India. Studies from Ethiopia identified several determinants of anemia, including low socioeconomic status, inadequate dietary diversity, multiparity, poor antenatal care utilization, large family size, and rural residence (Gudeta et al., 2018; Alie et al., 2016). Additional risk factors identified by Zhang J et al. (2022) included parasitic infections, low meal frequency, limited intake of meat and vegetables, short birth intervals, and poor nutritional status.

Growing evidence suggests that prevention and management of maternal anemia can improve pregnancy outcomes. Studies by Ribot et al. (2012) and Mary C. et al. (2003) demonstrated that adequate maternal iron stores and iron supplementation during pregnancy were associated with improved birth weight outcomes. Furthermore, da Silva Lopes et al. (2020) reported that daily iron supplementation effectively increased maternal hemoglobin levels and reduced the risk of anemia and iron deficiency during pregnancy.

Despite extensive research, maternal anemia remains highly prevalent and continues to contribute significantly to adverse maternal and neonatal outcomes worldwide. The consistency of evidence across systematic reviews, meta-analyses, cohort studies, and observational studies highlights maternal anemia as an important and potentially preventable risk factor. Therefore, a comprehensive review of the available literature is necessary to synthesize current evidence regarding the relationship between maternal anemia, preterm birth, and low birth weight, and to identify strategies for improving maternal and neonatal health outcomes.

Regional authorities considered the demographics and healthcare needs of the local population and modified the centralized guideline accordingly. They also provided better education and professional services for the public, which improved the quality of preconception services at both the regional and national levels (Yong-lan, 2003).

1.1 Objectives

1. To review the prevalence and determinants of maternal anemia.
2. To evaluate the association between maternal anemia and preterm birth.
3. To assess the relationship between maternal anemia and low birth weight.
4. To identify strategies for prevention and management of maternal anemia.

2. METHODOLOGY

2.1 Study Design

The present study was conducted as a narrative review of literature to examine the association between maternal anemia and adverse neonatal outcomes, particularly preterm birth and low birth weight. The review synthesized findings from previously published research studies conducted in different geographical settings and populations.

2.2 Sources of Literature

Relevant literature was identified from published articles available in national and international journals, systematic reviews, meta-analyses, cohort studies, case-control studies, cross-sectional studies, and observational studies. Studies investigating maternal anemia and its impact on pregnancy and neonatal outcomes were included in the review.

2.3 Search Strategy

A comprehensive literature search was performed using electronic databases such as PubMed, Google Scholar, Scopus, Web of Science, ResearchGate, and ScienceDirect. Various combinations of keywords and Medical Subject Headings (MeSH) terms were used, including:

- Maternal anemia
- Pregnancy anemia
- Iron deficiency anemia
- Preterm birth
- Premature delivery

· Low birth weight
· Neonatal outcomes
· Maternal health
· Pregnancy complications
· Hemoglobin levels during pregnancy

The search was limited to studies published in English.

2.4 Inclusion Criteria

Studies were included in the review if they:

1. Investigated anemia among pregnant women.
2. Reported neonatal outcomes such as preterm birth and low birth weight.
3. Included quantitative data on maternal hemoglobin levels.
4. Were published in peer-reviewed journals.
5. Used observational, cohort, case-control, cross-sectional, systematic review, or meta-analysis designs.
6. Were available in full-text format.

2.5 Exclusion Criteria

The following studies were excluded:

1. Studies not related to pregnancy.
2. Articles lacking sufficient outcome data.
3. Conference abstracts without full publications.
4. Editorials, commentaries, letters to editors, and opinion articles.
5. Duplicate publications.

2.6 Data Extraction

Information from selected studies was extracted using a structured review format. The following variables were recorded:

· Author and year of publication
· Country of study
· Study design
· Sample size
· Prevalence of maternal anemia
· Hemoglobin levels
· Incidence of preterm birth
· Incidence of low birth weight
· Major findings and conclusions

2.7 Data Synthesis

The findings from the selected studies were organized thematically according to the study objectives. Evidence regarding the prevalence of maternal anemia, its determinants, and its association with preterm birth and low birth weight was summarized and compared. Similarities and differences among study findings were identified and discussed.

2.8 Ethical Considerations

As this study was based entirely on published literature, no direct involvement of human participants occurred. Therefore, ethical approval and informed consent were not required. All reviewed studies were appropriately acknowledged and cited to maintain academic integrity and avoid plagiarism.

3. RESULTS

A comprehensive review of systematic reviews, meta-analyses, cohort studies, case-control studies, and cross-sectional studies was conducted to examine the association between maternal anaemia and adverse neonatal outcomes. Overall, the evidence consistently demonstrated that maternal anaemia is associated with an increased risk of preterm birth, low birth weight, and other adverse neonatal outcomes. Furthermore, the severity of anaemia was found to influence the magnitude of these risks.

3.1 Prevalence of Maternal Anaemia

The prevalence of maternal anaemia varied considerably across different geographical regions and populations. Kumari et al. (2019) reported a prevalence of 78.45% among pregnant women in Jharkhand, India, highlighting the substantial burden of anaemia in resource-limited settings. Similarly, Kabir et al. (2022) documented a prevalence of 44% among pregnant women in Bangladesh. In contrast, Li et al. (2018) reported a comparatively lower prevalence of 23.5% in China. Despite regional differences, these studies collectively indicate that maternal anaemia remains a major public health concern worldwide.

3.2 Maternal Anaemia and Low Birth Weight

A significant association between maternal anaemia and low birth weight (LBW) was reported in most of the reviewed studies. Figueiredo et al. (2018), through a systematic review and meta-analysis, concluded that maternal anaemia significantly increased the likelihood of delivering a low-birth-weight infant. Likewise, Mustansir et al. (2021) observed that low birth weight occurred more frequently among infants born to anaemic mothers than among those born to non-anaemic mothers.

A prospective cohort study conducted in Brazil demonstrated that maternal anaemia increased the risk of low and insufficient birth weight by approximately 38%. Similarly, Adhimukhti et al. (2023), in a meta-analysis of 17 cohort studies, reported that maternal anaemia increased the risk of low birth weight by nearly 35%. Furthermore, Kidanto et al. (2009) found that the risk of low birth weight increased progressively with worsening anaemia severity. Comparable findings were reported by Garshabi et al. (2006), Rani et al. (2017), and Bhaware et al. (2026), all of whom observed higher rates of low birth weight among women with moderate and severe anaemia.

3.3 Maternal Anaemia and Preterm Birth

The reviewed literature consistently demonstrated a strong association between maternal anaemia and preterm birth. Rahmati et al. (2020), in a large meta-analysis involving more than 932,000 women, reported that maternal anaemia increased the risk of preterm delivery by approximately 56%, with the strongest association observed among women who developed anaemia during the first trimester.

Similarly, Khezri et al. (2023) found that anaemic mothers were approximately 2.7 times more likely to experience preterm birth than non-anaemic mothers. Rani et al. (2017) also reported significantly higher rates of preterm delivery among women with moderate and severe anaemia. Additional studies by Yi et al. (2013), Kidanto et al. (2009), and Kumari et al. (2019) further demonstrated that the risk of preterm birth increased with increasing severity of maternal anaemia.

3.4 Effect of Anaemia Severity on Pregnancy Outcomes

Several studies highlighted a dose-response relationship between the severity of maternal anaemia and adverse pregnancy outcomes. Chen et al. (2024) reported that the risks of preterm birth, low birth weight, and small-for-gestational-age infants increased progressively as the severity of anaemia worsened. Similarly, Smith et al. (2019) observed that severe anaemia was associated with significantly poorer maternal and neonatal outcomes compared with mild anaemia.

Interestingly, Shi et al. (2021) suggested that mild anaemia may be associated with relatively favourable maternal and fetal outcomes, including improved fetal growth and survival. However, the majority of evidence indicated that moderate and severe anaemia substantially increased the risk of adverse outcomes.

Saraswathy et al. (2018–2019) reported that women with severe anaemia experienced notable maternal complications, including preterm labour, inadequate lactation, and puerperal febrile illness. Their study also documented adverse neonatal outcomes, including respiratory distress and feeding difficulties among newborns.

Hemoglobin levels below 11 g/dl were associated with an increased risk of preterm birth, low birth weight, and small gestational age in the first trimester, and with a higher risk of low birth weight in the third trimester(Sukrant et al.,2013)

3.5 Additional Neonatal Outcomes

In addition to preterm birth and low birth weight, maternal anaemia was associated with several other adverse neonatal outcomes. Rani et al. (2017) reported increased occurrences of neonatal anaemia, neonatal mortality, perinatal mortality, low APGAR scores, birth asphyxia, neonatal intensive care unit admissions, and small-for-gestational-age births among infants born to anaemic mothers.

Zhao et al. (2022) found significantly lower haemoglobin concentrations among neonates born to anaemic mothers compared with those born to mothers with normal haemoglobin levels. Similarly, Smith et al. (2019) and Mizanur et al. (2016) reported elevated rates of neonatal and perinatal mortality associated with maternal anaemia.

Benson et al. (2022) highlighted the long-term consequences of maternal iron deficiency, demonstrating an association between maternal anaemia and impaired neurodevelopmental outcomes extending from infancy to adolescence. Likewise, El Guindi et al. (2004) and Ren et al. (2007) emphasized that severe maternal anaemia adversely affects neonatal health and that routine iron supplementation during pregnancy can significantly improve outcomes.

3.6 Determinants of Maternal Anaemia

Several determinants of maternal anaemia were identified across the reviewed studies. Patel et al. (2018) reported that the coexistence of maternal anaemia and undernutrition was associated with the highest risks of stillbirth, neonatal mortality, and low birth weight. Conversely, maternal overweight and obesity were associated with increased delivery-related complications and caesarean section rates but a lower incidence of low birth weight.

Common risk factors identified across studies included poor dietary intake, iron and folate deficiencies, multiparity, multiple pregnancies, low socioeconomic status, rural residence, malaria, parasitic infections, inadequate antenatal care, short birth intervals, and low educational attainment. Studies conducted in Ethiopia, Bangladesh, India, and China consistently identified these factors as major contributors to maternal anaemia.

Alie et al. (2005–2016) analyzed Ethiopian demographic and health survey data and observed fluctuations in anaemia prevalence over time. Their findings indicated that maternal anaemia was associated with factors such as female-headed households, advanced gestational age, employment status, wealth status, and residence in specific geographical regions.

3.7 Prevention and Management

The reviewed evidence suggests that early prevention and effective management of maternal anaemia can improve both maternal and neonatal outcomes. Cantor et al. (2024) reported that iron supplementation effectively reduced iron deficiency during pregnancy, although additional evidence regarding broader maternal and infant health benefits remains necessary.

Finkelstein et al. demonstrated that comprehensive anaemia prevention programmes targeting women of reproductive age improved haematological status and maternal health outcomes. Recommended strategies identified across studies included routine antenatal screening, iron and folic acid supplementation, nutritional counselling, food fortification programmes, deworming, malaria prevention, improved antenatal care utilization, and preconception assessment of iron status.

Similarly, Totade et al. (2023) and Haider et al. (2013) emphasized the importance of integrated interventions such as iron supplementation, consumption of fortified foods, nutritional improvement, regular antenatal care, and active community participation. These authors highlighted the need for collaboration between healthcare providers, policymakers, and communities to effectively address maternal anaemia.

4.DISCUSSION

The present review synthesized evidence from systematic reviews, meta-analyses, cohort studies, case-control studies, and cross-sectional studies to examine the relationship between maternal anaemia and adverse pregnancy outcomes, particularly preterm birth and low birth weight. The findings consistently demonstrated that maternal anaemia is a significant risk factor for poor neonatal outcomes across diverse populations and healthcare settings. Despite variations in study design, sample size, and geographical location, the majority of studies reported a clear association between maternal anaemia and increased risks of preterm delivery and low birth weight.

One of the most important findings of this review was the consistent association between maternal anaemia and low birth weight. Studies conducted by Figueiredo et al. (2018), Adhimukhti et al. (2023), Mustansir et al. (2021), and Kidanto et al. (2009) reported that infants born to anaemic mothers were significantly more likely to have low birth weight compared with those born to non-anaemic mothers. Similar findings were observed across countries with varying socioeconomic conditions, suggesting that the relationship is not restricted to a particular population. Low birth weight remains one of the leading causes of neonatal morbidity and mortality worldwide, and maternal anaemia appears to contribute substantially to this burden.

The review also found strong evidence linking maternal anaemia with preterm birth. Rahmati et al. (2020), in a large meta-analysis involving more than 932,000 women, demonstrated a significantly increased risk of preterm delivery among anaemic mothers. Similar observations were reported by Khezri et al. (2023), Kumari et al. (2019), Yi et al. (2013), and Rani et al. (2017). Notably, several studies reported that anaemia during early pregnancy had a greater impact on gestational duration than anaemia developing later in pregnancy. This finding suggests that adequate maternal haemoglobin levels during the early stages of fetal development may play a critical role in maintaining normal pregnancy progression.

A notable observation across the reviewed studies was the dose-response relationship between the severity of maternal anaemia and adverse pregnancy outcomes. Women with moderate and severe anaemia consistently exhibited higher risks of preterm birth, low birth weight, small-for-gestational-age infants, neonatal complications, and perinatal mortality than women with mild anaemia or normal haemoglobin levels. Studies by Chen et al. (2024), Smith et al. (2019), and Li et al. (2022) demonstrated that worsening anaemia severity was associated with progressively poorer maternal and neonatal outcomes. This pattern strengthens the likelihood of a causal relationship and highlights the importance of preventing progression from mild to severe anaemia during pregnancy.

The biological mechanisms underlying these associations provide further support for the observed findings. Anaemia reduces the oxygen-carrying capacity of maternal blood, leading to decreased oxygen delivery to the placenta and fetus. Chronic fetal hypoxia may impair intrauterine growth and increase the likelihood of fetal growth restriction and low birth weight. Additionally, inadequate oxygenation may compromise placental function, resulting in placental insufficiency and premature activation of pathways involved in labour initiation. Iron deficiency, the most common cause of maternal anaemia, may also impair immune function and increase oxidative stress and inflammatory responses, all of which have been implicated in the development of preterm birth and other adverse pregnancy outcomes.

Beyond preterm birth and low birth weight, the reviewed literature highlighted several additional neonatal complications associated with maternal anaemia. Studies reported increased risks of neonatal anaemia, neonatal intensive care unit admission, birth asphyxia, low APGAR scores, neonatal mortality, and perinatal mortality among infants born to anaemic mothers. Zhao et al. (2022) demonstrated significantly lower haemoglobin levels among neonates of anaemic mothers, indicating a direct effect of maternal iron status on neonatal health. Furthermore, Benson et al. (2022) emphasized that maternal iron deficiency may have long-

term consequences on neurodevelopment, potentially affecting cognitive and behavioural outcomes throughout childhood and adolescence. These findings suggest that the impact of maternal anaemia extends beyond the perinatal period and may influence lifelong health outcomes.

The review also identified several determinants contributing to maternal anaemia. Poor dietary intake, iron and folate deficiencies, multiparity, short birth spacing, low socioeconomic status, inadequate antenatal care, malaria, and parasitic infections were repeatedly reported across studies. These factors are particularly common in low- and middle-income countries, where nutritional deficiencies and limited access to healthcare services remain major challenges. The persistence of these determinants helps explain the continued high prevalence of maternal anaemia despite global efforts to improve maternal health.

The findings of this review have important public health implications. Since maternal anaemia is largely preventable and treatable, early identification and timely intervention could substantially reduce the burden of adverse pregnancy outcomes. Routine antenatal screening, iron and folic acid supplementation, nutritional counselling, food fortification programmes, deworming strategies, and improved access to quality antenatal care are critical components of anaemia prevention and management. Studies by Haider et al. (2013), Totade et al. (2023), and Finkelstein et al. highlighted the effectiveness of such interventions in improving maternal haemoglobin status and pregnancy outcomes.

Although the evidence reviewed was largely consistent, some limitations should be acknowledged. Differences in diagnostic criteria for anaemia, timing of haemoglobin assessment, study designs, and adjustment for confounding factors may have contributed to variations in reported risk estimates. Additionally, many studies were observational in nature, which limits the ability to establish definitive causality. Nevertheless, the consistency of findings across multiple high-quality studies, systematic reviews, and meta-analyses provides strong evidence supporting the association between maternal anaemia and adverse neonatal outcomes.

Overall, the findings of this review reinforce the importance of maternal anaemia as a major and potentially modifiable risk factor for preterm birth, low birth weight, and other neonatal complications. Strengthening maternal nutrition programmes, improving antenatal care coverage, and ensuring timely diagnosis and treatment of anaemia should remain key priorities for healthcare systems worldwide. Addressing maternal anaemia effectively has the potential to improve both maternal and neonatal health outcomes and contribute to achieving global maternal and child health goals.

5.CONCLUSION

Maternal anemia remains a major public health concern and an important predictor of adverse pregnancy outcomes. The evidence reviewed demonstrated that anemia during pregnancy significantly increases the risk of preterm birth and low birth weight. Furthermore, the severity of anemia appears to be directly related to the magnitude of risk.

Strengthening antenatal screening, improving maternal nutrition, promoting iron supplementation, and implementing effective public health interventions are essential strategies for reducing the burden of maternal anemia and improving neonatal outcomes worldwide

5.1 Recommendations

Based on the findings of this review, the following recommendations are proposed:

1. Strengthen Antenatal Screening Programs

Routine screening for anaemia should be conducted during all antenatal visits, particularly during the first trimester, to ensure early identification and timely management of pregnant women at risk of adverse pregnancy outcomes.

2. Promote Iron and Folic Acid Supplementation

Healthcare providers should encourage regular iron and folic acid supplementation before conception and throughout pregnancy to prevent iron deficiency anaemia and reduce the risk of preterm birth and low birth weight.

3. Improve Maternal Nutrition

Nutritional counselling should be incorporated into antenatal care services. Pregnant women should be educated about consuming iron-rich foods such as green leafy vegetables, legumes, meat, fish, eggs, and fortified cereals, along with foods rich in vitamin C to enhance iron absorption.

4. Enhance Quality and Utilization of Antenatal Care

Access to comprehensive antenatal care services should be improved, particularly in rural and underserved areas. Regular antenatal visits can facilitate early detection of anaemia and other pregnancy-related complications.

5. Address Socioeconomic and Environmental Determinants

Government and public health agencies should implement strategies to address poverty, food insecurity, low educational status, and inadequate healthcare access, which are major contributors to maternal anaemia.

6. Strengthen Public Health Interventions

Community-based programmes such as food fortification, deworming initiatives, malaria prevention, and health education campaigns should be expanded to reduce the prevalence of maternal anaemia at the population level.

7. Promote Preconception Care

Women of reproductive age should undergo nutritional assessment and haemoglobin screening before pregnancy. Early correction of iron deficiency and nutritional deficiencies can improve maternal health and pregnancy outcomes.

8. Increase Awareness Among Pregnant Women

Health education programmes should be conducted to increase awareness regarding the causes, consequences, prevention, and treatment of maternal anaemia. Greater awareness may improve compliance with supplementation and antenatal care recommendations.

9. Strengthen Healthcare Provider Training

Continuous training of healthcare professionals should be undertaken to improve the diagnosis, prevention, counselling, and management of anaemia during pregnancy according to current evidence-based guidelines.

10. Encourage Further Research

Future studies should focus on evaluating the effectiveness of different anaemia prevention strategies, determining the optimal timing of interventions, and investigating the long-term effects of maternal anaemia on child growth, development, and health outcomes.

REFERENCE

1. Adhimukti F , U. R. Budihastuti, Bhisma Murti. (2023). Meta-Analysis. The effect of Anemia in pregnant women on the risk of post-partum bleeding and low birth weight. Journal of Maternal and Child Health .
2. Alie MS, Gichew S, Alemayehu D. (2024). Hotspot analysis of anaemia among pregnant women in Ethiopia: hotspot analysis of national demographic and health survey data. BMJ Open;14:e086539. doi:10.1136/ bmjopen-2024-086539.
3. Benson AE, Shatzel JJ, Ryan KS, Hedges MA, Martens K, Aslan JE, Lo JO. (2022). The incidence, complications, and treatment of iron deficiency in pregnancy. Eur J Haematol ;109(6):633-642. doi: 10.1111/ejh.13870. Epub 2022 Oct 4. PMID: 36153674; PMCID: PMC9669178.

4. Bhaware SS, Kumar KSK, Gawande P, Bhaware SM. (2026). Prospective Study to evaluate impact of maternal anemia on neonatal birth weight. Int J Clin Obstet Gynaecology, 10(2): 155-158. DOI 10.33545/ gynne.2026.v10.i2c.2045.
5. Cantor AG, Holmes R, Bougatsos C, Atchison C, DeLoughery T, Chou R. (2024). Screening and Supplementation for Iron Deficiency and Iron Deficiency Anemia During Pregnancy: Updated Evidence Report and Systematic Review for the US Preventive Services Task Force. JAMA;332(11):914–928. doi:10.1001/jama.13546.
6. Chen Y, Zhong T, Song X, Zhang S, Sun M, Liu X, Wei J, Shu J, Liu Y, Qin J. (2024). Maternal anaemia during early pregnancy and the risk of neonatal outcomes: a prospective cohort study in Central China. BMJ Paediatrics Open ;8: e001931. doi:10.1136/ bmjpo-2023-001931.
7. DeMaeyer, E. and Adiels-Tegman, M. (1985) The Prevalence of Anaemia in the World. World Health Statistics Quarterly, 38, 302-316.
8. Da Silva Lopes K, Yamaji N, Rahman MO, Suto M, Takemoto Y, Garcia-Casal MN, Ota E. (2021). Nutrition-specific interventions for preventing and controlling anaemia throughout the life cycle: an overview of systematic reviews. Cochrane Database of Systematic Reviews, (9). Art. No.: CD013092.
9. El Guindi, W., Pronost, J., Carles, G., Largeaud, M., el Gareh, N., Montoya, Y., & Arbeille, P. (2004). Severe maternal anemia and pregnancy outcome. Journal de gynecologie, obstetrique et biologie de la reproduction, 33 6 Pt 1, 506-9 .
10. Finkelstein JL, Kurpad AV, Bose B, Thomas T, Srinivasan K, Duggan C. (2020). Anaemia and iron deficiency in pregnancy and adverse perinatal outcomes in Southern India. Eur J Clin Nutr.;74(1):112-125. doi: 10.1038/s41430-019-0464-3. Epub 2019 Jul 11. PMID: 31296936; PMCID: PMC10122513.
11. Figueiredo, A. C. M. G., Gomes-Filho, I. S., Silva, R. B., Pereira, P. P. S., Mata, F. A. F. D., Lyrio, A. O., Souza, E. S., Cruz, S. S., & Pereira, M. G. (2018). Maternal Anemia and Low Birth Weight: A Systematic Review and Meta-Analysis. Nutrients, 10(5), 601. https://doi.org/10.3390/nu10050601.
12. Garshasbi, A., & Nader, F. (2006). Maternal hematocrite level and risk of low birth weight and preterm delivery. Tehran University Medical Journal TUMS Publications, 64, 87-94.
13. Gudeta TA, Regassa TM, Belay AS. (2019).Magnitude and factors associated with anaemia among pregnant women attending antenatal care in Bench Maji, Keffa and Sheka zones of public hospitals, Southwest, Ethiopia, 2018: A cross-sectional study. PLoS ONE 14(11): e0225148.
14. Haider BA, Olofin I,WangM, Spiegelman D, Ezzati Fawzi WW. (2013). Nutrition Impact Model Study Group (anaemia). Anaemia, prenatal iron use, and risk of adverse pregnancy outcomes: systematic review and meta-analysis. BMJ (Clin Res Ed.). 346: f3443. 10.1136/bmj. f3443.
15. JET, Orrico GS, Porto ECL, Cruz Pimenta RM, Dos Santos Conceicao S, Brito SM, Ramos MSX, Sena MCF, Vilasboas SWSL, Seixas da Cruz S, Pereira MG. (2019). Maternal Anaemia and birth weight: A prospective cohort study. PLoS One,18,14(3): e0212817.doi: 10.1371/journal.pone.0212817. PMID: 30884493, PMCID: PMC6422668.
16. Kidanto HL, Mogren I, Lindmark G, Massawe S, Nystrom L. (2009). Risks for preterm delivery and low birth weight are independently increased by severity of maternal anaemia. S Afr Med J., -9(2): 98-102. PMID: 19418670.
17. Khezri R, Salarilak S, Jahanian S. (2023). The association between maternal anaemia during pregnancy and preterm birth. Clinical Nutrition ESPEN; 56, 13-17.
18. Kabir M.A, Rahman M.M, Khan M.N (2022) Maternal anaemia and risk of adverse maternal health and birth outcomes in Bangladesh: A nationwide population-based survey. PLoS ONE 17(12): e0277654.
19. Kalaivani K , Ramachandran P. (2018); Time trends in prevalence of anaemia in pregnancy Indian J Med Res 147, pp 268-277. DOI: 10.4103/ijmr.IJMR_1730_16. PMID: 29923516
20. Kumari S, Garg N, KumarA ,Kumar P, Guru I, Ansari S, Anwar S, Singh, Kumari P, Mishra KP, GuptaBK, Nehar S, Sharma AK, Raziuddin M ,Sohail M. (2019). Maternal and severe anaemia in delivering women is associated with risk of preterm and low birth weight: A cross-sectional study from Jharkhand, India ; One Health; 8 (1) .100098. DOI:10.1016/j.onehlt.2019.100098.
21. Li J, Fang J, Luo J, Duan Y, Xiao X, Li Y, L M.(2022). The Association Between Severity of Anaemia During Pregnancy and Severe Maternal Outcomes: A Retrospective Cohort Study. Clinical Epidemiology,14 1427–1437.
22. Lin L, Wei Y, Zhu W, Wang C, Su R, Feng H, Yang H. (2018). Prevalence, risk factors and associated adverse pregnancy outcomes of anaemia in Chinese pregnant women: a multicentre retrospective study. BMC Pregnancy Childbirth;18(1):111. doi: 10.1186/s12884-018-1739-8. PMID: 29685119; PMCID: PMC5914057.
23. Mary C E , Ibrahim , Ickes Liza , Yip Ray , Brittenham Gary M .(2003). Iron supplementation during pregnancy, anemia, and birth weight: a randomized controlled trial. American Journal of Clinical Nutrition.78 (4),773-781.
24. Mustansir MA, Faisal AR, Tauqir I, Akhtar FN, Singh P, Butt US. (2021). Maternal Anemia and Fetal Birth Weight; a comparative, cross-sectional, multi-centric study. The professional Medical Journal. 28(08).
25. Mizanur R Md, Krull AS ,Shafiur R Md, Mikiko k, Saki N, Ver B, Erika O, Stuart G, Kenji S. (2016). Maternal anemia and risk of adverse birth and health outcomes in low- and middle-income countries: systematic review and meta-analysis. American Journal of clinical nutrition, 103 (2), 495-504.
26. Patel A, Prakash AA, Das PK. (2018). Maternal anaemia and underweight as determinants of pregnancy outcomes: cohort study in eastern rural Maharashtra, India. BMJ Open ;8:e021623. doi:10.1136/ bmjopen-2018-021623.
27. Ren, A., Wang, J., Ye, R.W., Li, S., Liu, J.M. and Li, Z. (2007). Low first-trimester hemoglobin and low birth weight, preterm birth and small for gestational age newborns. International Journal of Gynecology & Obstetrics, 98: 124- 128. https://doi.org/10.1016/j.ijgo.2007.05.011.
28. Ronkainen J, Lowry E, Heiskala A, Uusitalo I, Koivunen P, Kajantie E, Vaarasmaki M, Jarvelin M-R, Serbert S. (2019). Maternal hemoglobin associates with preterm delivery and small for gestational age in two Finnish birth cohorts. European Journal of Obstretics & Gynecology and Reproductive Biology.238, 44-48.
29. Ribot B, Aranda N, Viteri F, Hernández-Martínez C, Canals J, Arija V. (2012). Depleted iron stores without anaemia early in pregnancy carries increased risk of lower birthweight even when supplemented daily with moderate iron. Human Reproduction; 27(5), pp1260–1266. https://doi.org/10.1093/humrep/des026.

30. Rani, K. U., Gupta, J., Gupta, R., & Aggarwal, K. C. (2017). Maternal anaemia and its severity: an independent risk factor for preterm delivery and adverse neonatal outcome. International Journal of Reproduction, Contraception, Obstetrics and Gynecology, 3(2), 325–329. Retrieved from https://www.ijrcog.org/index.php/ijrcog/article/view/886.
31. Rahmati S, Azami M, Badfar G, Parizad N, & Sayehmiri K . (2020). The relationship between maternal anemia during pregnancy with preterm birth: a systematic review and met analysis. The Journal of Maternal – Fetal & Neonatal Medicine, 33(15), 2679-2689.https :// doi.org/10.1080/14767058.2018.1555811.
32. Saraswathy, V., Subashini, M, Jayavani, R. L., Vaidhyanathan, Usha, Mohan, Reena, Sindhuri, R. (2023). Predictors of maternal and fetal outcome in severely anemic pregnant mothers: A sequential mixed methods study. Journal of Family Medicine and Primary Care 12(11):p 2685-2689 DOI: 10.4103/jfmpc.jfmpc_1089_23.
33. Smith C, Teng F, Branch E, Chu S, Joseph KS. (2019). Maternal and Perinatal Morbidity and Mortality Associated With Anemia in Pregnancy. Obstet Gynecol;134(6):1234-1244. doi: 10.1097/AOG.0000000000003557. PMID: 31764734; PMCID: PMC6882541.
34. Sukrat B, Wilasrusmee C, Siribumrungwong B, McEvoy M, Okascharoen C, Attia J, Thakkinstian A. (2013). Hemoglobin concentration and pregnancy outcomes: a systematic review and meta-analysis. Biomed Research International. doi: 10.1155/2013/769057.PMID: 23984406; PMCID: PMC3741929. https://doi.org/10.1155/2013/769057
35. Shi, Chen, Y. Wang, Sun,Jiang, Xiaoxia Wang, Lu, Ge,Zhao,Wei,Qiao (2021).Severity of Anemia During Pregnancy and Adverse Maternal and Fetal Outcomes February 3, 2022.doi:10.1001/jamanetworkopen.2021.47046.
36. Totade M, Gaidhane A, Sahu P (October 07, 2023) Interventions in Maternal Anaemia to Reduce Maternal Mortality Rate Across India. Cureus 15(10): e46617. DOI 10.7759/cureus.46617.
37. Wang R, Xu S, Hao X, Jin X, Pan D, Xia H, Liao W, Yang L and Wang S (2025) Anemia during pregnancy and adverse pregnancy outcomes: a systematic review and meta-analysis of cohort studies. Front. Glob. Womens Health 6:1502585. doi: 10.3389/fgwh.2025.1502585.
38. Yi, S., Yj, H., & Ohrr, H. (2013). Anemia before pregnancy and risk of preterm birth, low birth weight and small-for-gestational-age birth in Korean women. European Journal of Clinical Nutrition, 67, 337-342.
39. Yong-lan, Z. (2003). Anemia During Pregnancy and Preterm Birth and Low Birth Weight:A Meta Analysis.medicine.
40. Zhao B. , Sun M., et al (2024) The association between maternal anemia and neonatal anemia: a systematic review and meta-analysis Zhao et al. BMC Pregnancy and Childbirth.
41. Zhang J, Li Q, Song Y, Fang L, Huang L and Sun Y. (2022) .Nutritional factors for anemia in pregnancy: A systematic review with meta analysis.