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Maternal Iron Deficiency Anemia: A Review of Causes, Consequences, and Care

*Emmanuel Ifeanyi Obeagu
Department of Biomedical and Laboratory Science, Africa University, Zimbabwe
E-mail: *emmanuelobeagu@yahoo.com*

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Abstract

Maternal iron deficiency anemia (IDA) is a significant global health concern, affecting over 40% of pregnant women worldwide, with disproportionately high prevalence in low- and middle-income countries. This condition arises primarily from inadequate dietary intake, increased iron requirements during pregnancy, and health conditions such as parasitic infections and malabsorption disorders. Iron deficiency impacts maternal oxygen transport and enzymatic processes, making pregnancy a critical period of vulnerability. Despite advancements in maternal healthcare, IDA continues to challenge global health systems, particularly in resource-limited settings. The consequences of maternal IDA extend beyond the mother, influencing fetal development and pregnancy outcomes. It is associated with preterm birth, low birth weight, and neurodevelopmental deficits in offspring, as well as maternal fatigue and increased risk of peripartum complications. These adverse outcomes underscore the need for comprehensive care strategies to mitigate IDA's impact on both maternal and child health. Addressing the burden of IDA is essential for improving maternal and neonatal well-being and achieving global health targets.

Introduction

Iron deficiency anemia (IDA) during pregnancy is a pervasive global health issue, particularly affecting low- and middle-income countries. It is estimated that over 40% of pregnant women worldwide suffer from anemia, with iron deficiency being the most common underlying cause. Pregnancy is a unique physiological state that increases maternal nutritional demands, particularly for iron, as the body supports maternal blood volume expansion, fetal development, and placental growth. Failure to meet these heightened iron needs can result in depleted iron stores and anemia, posing significant risks to both maternal and fetal health.[1-2] The pathophysiology of IDA in pregnancy is multifactorial, influenced by dietary

inadequacies, increased iron demands, and health-related factors such as parasitic infections and chronic diseases. Diets lacking in bioavailable iron, particularly in regions where plant-based diets predominate, significantly contribute to this condition. In addition, socioeconomic factors, limited healthcare access, and cultural practices can exacerbate the risk of IDA, further complicating its management and prevention.[3-4] IDA in pregnancy is not merely a clinical concern but a public health issue due to its profound implications for maternal and neonatal outcomes. For mothers, IDA is associated with fatigue, reduced physical work capacity, and increased susceptibility to infections. Severe anemia increases the risk of maternal mortality due to peripartum hemorrhage and other complications. For the fetus, the consequences include intrauterine growth restriction, preterm delivery, low birth weight, and long-term developmental impairments. These outcomes highlight the critical importance of addressing IDA during pregnancy.[5-6]

Despite its prevalence and impact, maternal IDA remains underdiagnosed and undertreated in many parts of the world. Limited awareness among pregnant women, cultural misconceptions about supplementation, and inadequate healthcare infrastructure are significant barriers to effective intervention. Moreover, disparities in healthcare access between high-income and low-income regions widen the gap in prevention and treatment, necessitating targeted strategies to address these inequities.[7-8] A growing body of research emphasizes the need for a comprehensive approach to prevent and manage IDA in pregnancy. Interventions range from dietary modifications and iron supplementation to broader public health measures such as food fortification and deworming programs. Tailoring these strategies to regional and individual needs is crucial for their success. Additionally, improving antenatal care services and ensuring early detection of anemia are essential steps in reducing its burden.[9-10]This review aims to explore the causes, consequences, and care strategies associated with maternal IDA.

Causes of Maternal Iron Deficiency Anemia

Maternal iron deficiency anemia (IDA) arises from a combination of physiological, dietary, and pathological factors.

1. Inadequate Dietary Iron Intake

Dietary insufficiency of iron is a primary cause of IDA, particularly in regions where consumption of iron-rich foods is limited. Heme iron, found in animal-based foods such as meat, poultry, and fish, is more bioavailable than non-heme iron from plant-based sources. Diets predominantly composed of cereals and legumes, common in low-income settings, provide non-heme iron with low absorption efficiency. Furthermore, cultural or economic barriers to accessing diverse foods exacerbate dietary iron deficiencies during pregnancy.[11-12]

2. Increased Iron Demands of Pregnancy

Pregnancy induces a physiological increase in iron requirements due to maternal blood volume expansion, placental growth, and fetal development. Iron is essential for hemoglobin production and oxygen transport, both of which are crucial for supporting these processes. By the third trimester, daily iron needs increase to approximately 27 mg, often surpassing what can be obtained from diet alone, especially if pre-pregnancy iron stores were inadequate.[13]

3. Chronic Blood Loss

Chronic blood loss is another significant contributor to IDA. Menorrhagia before pregnancy or frequent bleeding episodes from conditions like hemorrhoids can deplete iron stores. Additionally, parasitic infections such as hookworm and schistosomiasis, common in tropical regions, cause gastrointestinal blood loss, further reducing iron availability.[14]

4. Poor Iron Absorption

Even when dietary iron intake is sufficient, conditions impairing iron absorption can

contribute to IDA. Gastrointestinal disorders such as celiac disease, inflammatory bowel disease, and Helicobacter pylori infections can reduce the intestine's ability to absorb iron effectively. Furthermore, co-consumption of dietary inhibitors like phytates (found in whole grains), calcium, and polyphenols (in tea and coffee) can interfere with iron absorption.[15]

5. Pre-Pregnancy Iron Deficiency

Many women enter pregnancy with depleted iron stores due to prior undiagnosed or untreated anemia. Factors such as inadequate nutrition during adolescence, frequent pregnancies with short interpregnancy intervals, and heavy menstrual cycles can reduce iron levels over time, leaving women vulnerable to IDA when pregnancy increases their requirements.[16]

6. Socioeconomic and Healthcare Factors

Low socioeconomic status, limited access to healthcare, and inadequate antenatal care services are significant determinants of maternal IDA. Women in impoverished regions are less likely to receive iron supplementation or education about dietary modifications. In many cases, cultural misconceptions about the safety of iron supplements during pregnancy further hinder intervention efforts.[17]

Consequences of Maternal Iron Deficiency Anemia

Maternal iron deficiency anemia (IDA) poses significant risks to the health and well-being of both the mother and her child. These consequences range from immediate health complications to long-term developmental and societal impacts.

1. Consequences for Maternal Health

- **Fatigue and Reduced Physical Function**: IDA leads to decreased hemoglobin levels, impairing oxygen delivery to tissues and resulting in chronic fatigue, weakness, and diminished work capacity. These effects can reduce a pregnant woman's ability to perform daily activities, affecting her quality of life.[18]
- **Increased Risk of Maternal Mortality**: Severe anemia increases the risk of complications during childbirth, particularly postpartum hemorrhage, which is a leading cause of maternal mortality. Women with IDA are less equipped to cope with blood loss, making them more vulnerable to life-threatening outcomes.[19]
- **Heightened Susceptibility to Infections**: Iron plays a vital role in immune function, and its deficiency can compromise maternal immunity, increasing the risk of infections during pregnancy and the postpartum period.

2. Consequences for Pregnancy Outcomes

- **Preterm Birth and Low Birth Weight**: IDA has been strongly associated with preterm delivery and intrauterine growth restriction, resulting in babies born prematurely or with low birth weight. These outcomes contribute to increased neonatal morbidity and mortality rates.[20]
- **Placental and Peripartum Complications**: Anemic mothers may experience complications such as placental abruption and prolonged labor, further endangering both maternal and fetal health.[21]

3. Consequences for Fetal and Neonatal Health

- **Impaired Fetal Development**: Iron is essential for fetal brain development, particularly during the last trimester of pregnancy. IDA during this critical period can result in impaired cognitive, motor, and behavioral development in the child.[22]
- **Increased Risk of Neonatal Anemia**: Infants born to mothers with IDA often have reduced iron stores, predisposing them to anemia during infancy, which can further impact their growth and development.[23]

4. Long-term Consequences for Offspring

- **Neurodevelopmental Deficits**: Studies suggest that children born to mothers with

IDA are at a higher risk of long-term neurocognitive impairments, including learning difficulties and reduced academic performance.[24]

- **Chronic Health Issues**: The effects of maternal IDA may extend into adolescence and adulthood, predisposing offspring to metabolic and cardiovascular disorders due to alterations in fetal programming.[25]

5. Socioeconomic and Public Health Impacts

- **Increased Healthcare Costs**: The complications associated with maternal IDA, including hospitalizations, preterm births, and neonatal intensive care, significantly burden healthcare systems, particularly in low-resource settings.[26]
- **Reduced Workforce Productivity**: Maternal and childhood anemia contribute to reduced workforce productivity, perpetuating cycles of poverty and health disparities in affected communities.[27]

Care Strategies for Maternal Iron Deficiency Anemia

Effective care strategies for maternal iron deficiency anemia (IDA) are crucial to improve maternal and fetal outcomes and mitigate associated risks. These strategies encompass preventive measures, therapeutic interventions, and public health approaches tailored to the needs of pregnant women.[28]

1. Dietary Modifications

- **Increased Iron-Rich Foods**: Encouraging the consumption of iron-rich foods is a foundational strategy. Sources include red meat, poultry, fish (heme iron), and plant-based options like lentils, spinach, and fortified cereals (non-heme iron).[29]
- **Dietary Enhancers**: Promoting the intake of vitamin C-rich foods (e.g., citrus fruits, bell peppers) enhances non-heme iron absorption. Conversely, reducing consumption of inhibitors like tea, coffee, and calcium-rich foods during meals can improve iron uptake.[30]

2. Iron Supplementation

- **Oral Iron Supplements**: Daily or intermittent iron supplementation is the cornerstone of IDA management during pregnancy. Standard guidelines recommend 30–60 mg of elemental iron combined with folic acid for pregnant women in regions with high anemia prevalence.
- **Intravenous Iron Therapy**: For women with severe anemia, oral iron intolerance, or late gestational diagnosis, intravenous iron formulations provide a faster and more effective means of replenishing iron stores.[3]

3. Management of Underlying Conditions

- **Treatment of Infections**: Addressing parasitic infections such as hookworm or malaria is critical in endemic areas. Deworming during pregnancy and antimalarial prophylaxis can reduce chronic blood loss and inflammation associated with these conditions.
- **Addressing Gastrointestinal Disorders**: Identifying and managing conditions like celiac disease or Helicobacter pylori infection can improve iron absorption and overall health.[32]

4. Public Health Interventions

- **Food Fortification**: Fortifying staples such as wheat flour, rice, and salt with iron and other micronutrients is an effective strategy to reduce population-level iron deficiency, especially in resource-limited settings.
- **Community Health Programs**: Conducting awareness campaigns about anemia, emphasizing the importance of antenatal care (ANC), and providing nutrition education can empower women to adopt preventive measures.[33]

5. Antenatal Care Services

- **Routine Screening**: Early detection through regular hemoglobin and ferritin level assessments during ANC visits ensures timely intervention. Integrating anemia screening with broader maternal health services is vital.[34]

- **Individualized Care Plans**: Tailoring interventions to each woman's risk factors, dietary habits, and health conditions enhances the effectiveness of care.[35]

6. Policy and Multisectoral Approaches

- **Strengthening Healthcare Systems**: Ensuring access to affordable iron supplements, improving healthcare infrastructure, and training healthcare workers are critical for addressing IDA at scale.
- **Collaboration Across Sectors**: Partnerships between governments, NGOs, and private sectors can drive sustainable initiatives, such as maternal nutrition programs and fortified food distribution.[36]

Conclusion

Maternal iron deficiency anemia (IDA) remains a pervasive global health challenge with profound implications for maternal and fetal well-being. Its multifactorial etiology, encompassing dietary insufficiencies, increased physiological demands, and underlying health conditions, highlights the need for tailored prevention and management strategies. The consequences of maternal IDA, including maternal fatigue, heightened infection risks, preterm delivery, low birth weight, and long-term developmental deficits in offspring, underscore its far-reaching impact.

References

1. Owais A, Merritt C, Lee C, Bhutta ZA. Anemia among women of reproductive age: an overview of global burden, trends, determinants, and drivers of progress in low- and middle-income countries. Nutrients. 2021; 13(8):2745.
2. World Health Organization. Worldwide prevalence of anaemia 1993-2005: WHO global database on anaemia. 2008.
3. Agreen FC, Obeagu EI. Anaemia among pregnant women: A review of African pregnant teenagers. Journal of Public Health and Nutrition. 2023;6(1):138.
4. Obeagu EI, Obeagu GU, Chukwueze CM, Ikpenwa JN, Ramos GF. Evaluation of protein C, protein S and fibrinogen of pregnant women with malaria in Owerri metropolis. Madonna University journal of Medicine and Health Sciences. 2022; 2(2):1-9.
5. Means RT. Iron deficiency and iron deficiency anemia: implications and impact in pregnancy, fetal development, and early childhood parameters. Nutrients. 2020; 12(2):447.
6. Obeagu EI, Adepoju OJ, Okafor CJ, Obeagu GU, Ibekwe AM, Okpala PU, Agu CC. Assessment of Haematological Changes in Pregnant Women of Ido, Ondo State, Nigeria. J Res Med Dent Sci. 2021 Apr;9(4):145-8.
7. Obeagu EI, Obeagu GU. Neonatal Outcomes in Children Born to Mothers with Severe Malaria, HIV, and Transfusion History: A Review. Elite Journal of Nursing and Health Science, 2024; 2(3): 38-58
8. Sapehia D, Mahajan A, Srinivasan R, Kaur J. Pre-natal dietary imbalance of folic acid and vitamin B12 deficiency adversely impacts placental development and fetal growth. Placenta. 2023; 132:44-54.
9. Obeagu EI, Obeagu GU. Sickle cell anaemia in pregnancy: a review. International Research in Medical and Health Sciences. 2023 Jun 10;6(2):10-3.
10. Obeagu EI, Obeagu GU. Hemolysis Challenges for Pregnant Women with Sickle Cell Anemia: A Review. Elite Journal of Haematology. 2024;2(3):67-80.
11. Obeagu EI, Ezimah AC, Obeagu GU. Erythropoietin in the anaemias of pregnancy: a review. Int J Curr Res Chem Pharm Sci. 2016;3(3):10-8.
12. Muñoz M, Peña-Rosas JP, Robinson S, Milman N, Holzgreve W, Breymann C, Goffinet F, Nizard J, Christory F, Samama CM, Hardy JF. Patient blood management in obstetrics: management of anaemia and haematinic deficiencies in pregnancy and in the post-partum period: NATA consensus statement. Transfusion medicine. 2018; 28(1):22-39.

13. Breymann C. Iron deficiency anemia in pregnancy. InSeminars in hematology 2015; 52(4):339-347. WB Saunders.
14. Green R, Mitra AD. Megaloblastic anemias: nutritional and other causes. Medical Clinics. 2017; 101(2):297-317.
15. Rashid S, Meier V, Patrick H. Review of Vitamin B12 deficiency in pregnancy: a diagnosis not to miss as veganism and vegetarianism become more prevalent. European journal of haematology. 2021; 106(4):450-455.
16. Jagnade RS, Bharat R, Singh P. Association Between Systemically Healthy Chronic Periodontitis Pregnant Female Subjects and Anemia of Chronic Diseases: A Clinical Study. Journal of Advanced Medical and Dental Sciences Research. 2018;6(9):88-95.
17. Barrera-Reyes PK, Tejero ME. Genetic variation influencing hemoglobin levels and risk for anemia across populations. Annals of the New York Academy of Sciences. 2019; 1450(1):32-46.
18. Guyatt GH, Oxman AD, Ali M, Willan A, McIlroy W, Patterson C. Laboratory diagnosis of iron-deficiency anemia: an overview. Journal of general internal medicine. 1992; 7:145-53.
19. Eweis M, Farid EZ, El-Malky N, Abdel-Rasheed M, Salem S, Shawky S. Prevalence and determinants of anemia during the third trimester of pregnancy. Clinical Nutrition ESPEN. 2021;44:194-199.
20. Agbozo F, Abubakari A, Der J, Jahn A. Maternal dietary intakes, red blood cell indices and risk for anemia in the first, second and third trimesters of pregnancy and at predelivery. Nutrients. 2020; 12(3):777.
21. Siteti MC, Namasaka SD, Ariya OP, Injete SD, Wanyonyi WA. Anaemia in pregnancy: Prevalence and possible risk factors in Kakamega County, Kenya. Science journal of public health. 2014;2(3):216-222.
22. Kumar SB, Arnipalli SR, Mehta P, Carrau S, Ziouzenkova O. Iron deficiency anemia: efficacy and limitations of nutritional and comprehensive mitigation strategies. Nutrients. 2022; 14(14):2976.
23. Pai RD, Chong YS, Clemente-Chua LR, Irwinda R, Huynh TN, Wibowo N, Gamilla MC, Mahdy ZA. Prevention and management of iron deficiency/iron-deficiency anemia in women: an Asian expert consensus. Nutrients. 2023; 15(14):3125.
24. Muñoz M, Peña-Rosas JP, Robinson S, Milman N, Holzgreve W, Breymann C, Goffinet F, Nizard J, Christory F, Samama CM, Hardy JF. Patient blood management in obstetrics: management of anaemia and haematinic deficiencies in pregnancy and in the post-partum period: NATA consensus statement. Transfusion medicine. 2018;28(1):22-39.
25. Shi H, Chen L, Wang Y, Sun M, Guo Y, Ma S, Wang X, Jiang H, Wang X, Lu J, Ge L. Severity of anemia during pregnancy and adverse maternal and fetal outcomes. JAMA network open. 2022;5(2):e2147046-.
26. World Health Organization. Guideline: daily iron and folic acid supplementation in pregnant women. World Health Organization; 2012.
27. Obeagu EI, Obeagu GU. Sickle cell anaemia in pregnancy: a review. International Research in Medical and Health Sciences. 2023 Jun 10;6(2):10-3.
28. Obeagu EI, Ubosi NI, Uzoma G. Antioxidant Supplementation in Pregnancy: Effects on Maternal and Infant Health. Int. J. Adv. Multidiscip. Res. 2023;10(11):60-70.
29. Obeagu EI, Ubosi NI, Uzoma G. Antioxidant Supplementation in Pregnancy: Effects on Maternal and Infant Health. Int. J. Adv. Multidiscip. Res. 2023;10(11):60-70.
30. Obeagu EI, Obeagu GU. Enhancing Maternal and Fetal Well-being: The Role of Antioxidants in Pregnancy. Elite Journal of Medical Sciences. 2024;2(4):76-87.
31. Obeagu EI, Obeagu GU. Antioxidant Supplementation and Prevention of Early Pregnancy Loss: A Narrative Review. Int. J. Curr. Res. Chem. Pharm. Sci. 2024;11(9):28-37.
32. Obeagu EI, Obeagu GU. Molar Pregnancy: Update of prevalence and risk factors. Int. J. Curr. Res. Med. Sci. 2023;9(7):25-8.

33. Obeagu EI, Obeagu GU. Hypoxia-induced Metabolic Changes in Pregnancy: Clinical Perspectives. Elite Journal of Medicine. 2024;2(8):50-9.
34. Obeagu EI, Obeagu GU. Hemolysis Challenges for Pregnant Women with Sickle Cell Anemia: A Review. Elite Journal of Haematology. 2024;2(3):67-80.
35. Obeagu EI, Obeagu GU, Ezeonwumelu JO. Safety and Efficacy of Blood Transfusions in Pregnant Women. Elite Journal of Haematology, 2024; 2 (3).:96-106.
36. Obeagu EI, Obeagu GU. Hypoxia in Pregnancy: Implications for Fetal Development. Int. J. Curr. Res. Chem. Pharm. Sci. 2024;11(7):39-50.

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