INTERNATIONAL JOURNAL OF CURRENT RESEARCH IN CHEMISTRY AND PHARMACEUTICAL SCIENCES
(p-ISSN: 2348-5213: e-ISSN: 2348-5221)
www.ijcrcps.com
(A Peer Reviewed, Referred, Indexed and Open Access Journal)
DOI: 10.22192/ijcrcps Coden: IJCROO(USA) Volume 11, Issue 11- 2024

Review Article

DOI: http://dx.doi.org/10.22192/ijcrcps.2024.11.11.005

Iron Deficiency Anemia: Maternal and Fetal Outcomes in Pregnancy

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

Abstract

Iron deficiency anemia (IDA) is the most prevalent nutritional deficiency during pregnancy, posing significant risks to maternal and fetal health. It arises due to the increased iron demands of pregnancy, coupled with inadequate dietary intake or absorption. Maternal IDA has been linked to adverse outcomes such as preterm delivery, postpartum hemorrhage, and maternal mortality. Additionally, it negatively impacts maternal quality of life by causing fatigue, reduced cognitive function, and increased susceptibility to infections. These challenges underscore the importance of addressing IDA as a public health priority. The consequences of IDA extend to the fetus, with profound implications for growth and development. Infants born to mothers with IDA are at increased risk of low birth weight, preterm birth, and impaired neurodevelopment. Furthermore, maternal IDA can deplete fetal iron stores, predisposing infants to anemia and developmental delays in early childhood. These outcomes highlight the critical role of maternal iron status in shaping neonatal and childhood health trajectories.

Keywords: Iron Deficiency Anemia, Pregnancy, Maternal Outcomes, Fetal Outcomes, Perinatal Health

Introduction

Iron deficiency anemia (IDA) is the most common nutritional disorder globally and remains a major public health concern, particularly during pregnancy. It is characterized by reduced hemoglobin levels due to insufficient iron, leading to impaired oxygen transport in the body. The World Health Organization (WHO) estimates that anemia affects 40% of pregnant women worldwide, with iron deficiency accounting for a significant proportion of cases. This condition

disproportionately impacts low- and middle-income countries, where dietary iron intake is often insufficient and access to healthcare is limited.[1-2] Pregnancy places significant physiological demands on maternal iron stores, as iron is required for increased red blood cell production, placental development, and fetal growth. These demands, compounded by baseline deficiencies and factors such as blood loss, infections, and inflammation, often result in iron depletion during pregnancy. If untreated, IDA can lead to severe maternal and fetal complications, with far-reaching consequences for the health and well-being of both mother and child.[3-4] For the mother, IDA increases the risk of obstetric complications, including preterm delivery, postpartum hemorrhage, and even maternal mortality in severe cases. Beyond these life-threatening conditions, maternal IDA significantly affects daily life, causing fatigue, weakness, and diminished cognitive function. These symptoms can impair a mother's ability to engage in prenatal care, maintain employment, or care for her family, further exacerbating health inequities and economic challenges.[5-6]

The adverse effects of maternal IDA are not limited to the mother; they extend to the fetus and neonate as well. Iron plays a critical role in fetal development, particularly for the brain and nervous system. Infants born to iron-deficient mothers are at heightened risk of low birth weight, preterm birth, and impaired cognitive development. Moreover, depleted fetal iron stores increase the likelihood of anemia in infancy, perpetuating a cycle of poor health outcomes that can extend into adulthood.[7-8] Despite the significant impact of IDA, it is a preventable and treatable condition. Timely detection through reliable diagnostic tools, including serum ferritin and transferrin saturation tests, is essential for mitigating the risks. Effective interventions, such as iron supplementation and dietary counseling, are widely available and can dramatically improve outcomes for both mothers and their babies. However, challenges persist, including low adherence to supplementation, limited healthcare access, and cultural dietary practices that may hinder the uptake of iron-rich foods.[9-10]

Maternal Outcomes

1. Increased Maternal Morbidity and Mortality

Iron deficiency anemia (IDA) during pregnancy is associated with a heightened risk of maternal morbidity and mortality. Anemia reduces oxygen transport capacity, compromising maternal cardiac output and increasing susceptibility to peripartum complications, such as postpartum hemorrhage and preeclampsia. Severe anemia (hemoglobin levels below 7 g/dL) has been linked to a higher likelihood of maternal death, particularly in low-resource settings where emergency obstetric care may be inadequate. Additionally, anemia exacerbates complications such as infections, which are more frequent and severe in anemic pregnant women due to compromised immune function.[11-12]

2. Obstetric Complications

Pregnant women with IDA face an increased likelihood of adverse obstetric outcomes, including preterm labor, prolonged delivery, and uterine atony. These complications are partly attributable to reduced oxygen supply to uterine muscles, impairing their ability to contract effectively during labor. Moreover, IDA contributes to poor placental development and function, which can exacerbate pregnancy complications. Postpartum recovery is also affected, with delayed wound healing and prolonged hospital stays often observed in anemic mothers.[13-14]

3. Impaired Quality of Life and Productivity

Maternal IDA significantly impacts daily life by causing symptoms such as fatigue, dizziness, and reduced cognitive and physical performance. These symptoms diminish the mother's ability to perform household responsibilities, maintain employment, and adhere to prenatal care regimens. Psychosocial stress and mental health challenges, including depression and anxiety, are also more prevalent in anemic pregnant women. Furthermore, fatigue and weakness resulting from

IDA may interfere with breastfeeding and postnatal care, further affecting maternal and infant health.[15-16]

4. Nutritional and Immune Deficiencies

Iron plays a vital role in immune system function, and its deficiency during pregnancy leaves women more vulnerable to infections, including urinary tract infections and respiratory illnesses. Concurrently, IDA is often associated with deficiencies in other micronutrients, such as folic acid and vitamin B12, which are essential for hematopoiesis. These deficiencies can compound the negative effects of IDA, leading to more severe health outcomes.[17]

5. Socioeconomic and Psychological Impact

In regions where IDA is prevalent, the economic burden of managing anemia-related complications adds to maternal stress. Increased healthcare costs, reduced household productivity, and caregiving challenges strain families financially and emotionally. The stigma associated with physical weakness or frequent illness may further contribute to psychosocial distress in affected women.[18]

6. Long-term Maternal Health Risks

Untreated IDA during pregnancy has implications beyond the perinatal period. Women with a history of severe anemia are more likely to develop chronic conditions such as cardiovascular disease later in life. Additionally, repeated episodes of IDA in subsequent pregnancies can lead to cumulative health deterioration, emphasizing the importance of addressing anemia comprehensively during prenatal care.[19]

Fetal Outcomes

1. Intrauterine Growth Restriction (IUGR) and Low Birth Weight

Iron deficiency anemia (IDA) in pregnant women is closely associated with intrauterine growth restriction (IUGR) and low birth weight. Iron is crucial for fetal growth and development, and maternal IDA can lead to reduced oxygen delivery to the fetus due to impaired hemoglobin function. This oxygen deficiency can hinder proper fetal growth, increasing the risk of low birth weight (<2.5 kg) and contributing to neonatal morbidity and mortality. IUGR also predisposes infants to a higher likelihood of developing chronic health issues later in life, such as metabolic syndrome and cardiovascular diseases.[20]

2. Prematurity and Preterm Birth

IDA significantly increases the risk of preterm birth, defined as delivery before 37 weeks of gestation. The mechanisms linking IDA to preterm delivery include placental hypoxia, inflammation, and elevated levels of oxidative stress, all of which can trigger premature uterine contractions or placental abruption. Preterm infants face numerous complications, including respiratory distress syndrome, sepsis, and long-term neurodevelopmental challenges. These outcomes underline the importance of maintaining adequate maternal iron levels to support a full-term pregnancy.[21]

3. Impaired Neurodevelopment

Iron is essential for the development of the fetal brain and nervous system, particularly during the third trimester, when brain growth is most rapid. Maternal IDA during pregnancy can disrupt iron transport to the fetus, affecting the development of critical neural pathways. This disruption has been associated with delayed cognitive, motor, and behavioral development in children. Studies have shown that children born to anemic mothers are at higher risk of developmental delays, attention-deficit hyperactivity disorder (ADHD), and learning difficulties, emphasizing the long-term consequences of prenatal iron deficiency.[22]

4. Neonatal Anemia

Infants of mothers with IDA often experience low iron stores at birth, making them more susceptible to neonatal anemia. This condition can arise due

to reduced iron transfer across the placenta during pregnancy. Neonatal anemia can further exacerbate developmental and growth challenges, particularly in resource-limited settings where access to iron supplementation or fortified nutrition may be limited.[23]

5. Increased Risk of Perinatal Mortality

Severe maternal anemia has been linked to an elevated risk of perinatal mortality, which encompasses stillbirths and early neonatal deaths. Hypoxia resulting from inadequate oxygen transport due to maternal anemia can lead to fetal distress, increasing the likelihood of intrauterine death. Additionally, the risk of stillbirth is heightened in pregnancies complicated by severe IDA, highlighting the urgent need for early detection and intervention.[24]

6. Long-term Health Implications for Offspring

Emerging research suggests that IDA during pregnancy may have epigenetic effects, influencing gene expression in the developing fetus. These changes can predispose offspring to a range of chronic conditions, including obesity, diabetes, and cardiovascular diseases, in adulthood. The concept of "fetal programming" underscores how the intrauterine environment shapes long-term health trajectories, making maternal iron status a critical factor for future population health.[24]

Diagnostic Approaches

1. Hemoglobin and Hematocrit Levels

The initial step in diagnosing iron deficiency anemia (IDA) during pregnancy involves measuring hemoglobin (Hb) and hematocrit levels. Hemoglobin levels below 11 g/dL in the first and third trimesters or below 10.5 g/dL in the second trimester are indicative of anemia, according to World Health Organization (WHO) guidelines. While these tests are useful for screening, they lack specificity for distinguishing IDA from other types of anemia, such as those caused by folate or vitamin B12 deficiencies.[25]

2. Serum Ferritin Measurement

Serum ferritin, a marker of iron stores, is the most reliable diagnostic tool for identifying IDA. Low serum ferritin levels (<15 µg/L) are highly indicative of iron deficiency. However, ferritin is an acute-phase reactant and may be elevated in the presence of inflammation or infection, potentially masking iron deficiency. Adjusting ferritin thresholds during inflammatory conditions, such as by using C-reactive protein (CRP) or alpha-1-acid glycoprotein levels, can improve diagnostic accuracy.[26]

3. Transferrin Saturation and Total Iron Binding Capacity (TIBC)

Transferrin saturation (TSAT), calculated as the ratio of serum iron to total iron-binding capacity (TIBC), provides additional insights into iron availability for erythropoiesis. A TSAT below 20% suggests iron deficiency. TIBC is typically elevated in IDA, reflecting increased production of transferrin in response to depleted iron stores. These tests are particularly useful in distinguishing IDA from anemia of chronic disease, where TIBC is often normal or decreased.[27]

4. Peripheral Blood Smear Examination

A peripheral blood smear can reveal characteristic features of IDA, including microcytic (small-sized) and hypochromic (pale-colored) red blood cells. Anisocytosis (variation in red blood cell size) and poikilocytosis (abnormal shapes) may also be present. While not specific for IDA, these findings provide supportive evidence when combined with biochemical markers.[28]

5. Reticulocyte Hemoglobin Content (CHr)

Reticulocyte hemoglobin content (CHr) is an emerging diagnostic parameter that reflects the hemoglobin content of newly formed red blood cells. CHr levels below 28 pg are indicative of

iron-restricted erythropoiesis. This test is particularly valuable for detecting early-stage IDA before significant changes in hemoglobin levels occur.[29]

6. Soluble Transferrin Receptor (sTfR)

Soluble transferrin receptor (sTfR) levels are elevated in IDA and remain unaffected by inflammation, making it a useful diagnostic tool in patients with concurrent infections or chronic diseases. The sTfR/log ferritin ratio, known as the sTfR index, has been proposed as a reliable marker for distinguishing IDA from anemia of chronic disease.[30]

7. Advanced Techniques: Hepcidin and Zinc Protoporphyrin

Hepcidin, a regulatory hormone of iron metabolism, is decreased in IDA and increased in anemia of chronic disease. Measuring hepcidin levels can aid in differentiating these conditions, although its routine use is limited by high costs and lack of standardization. Similarly, zinc protoporphyrin (ZPP), a byproduct of impaired heme synthesis, is elevated in IDA and can serve as an adjunctive diagnostic tool.[31]

8. Integration of Diagnostic Approaches

Given the multifactorial nature of anemia during pregnancy, a combination of diagnostic tests is often necessary for accurate identification and classification of IDA. Sequential testing, starting with hemoglobin and ferritin levels and followed by more specific markers such as TSAT or sTfR, can enhance diagnostic precision. Point-of-care testing and algorithms integrating clinical, biochemical, and hematological data are emerging as practical solutions for resource-limited settings.[32]

Management Strategies

1. Nutritional Interventions

Nutritional interventions form the cornerstone of managing iron deficiency anemia (IDA) during pregnancy. Increasing dietary intake of iron-rich foods, such as red meat, poultry, fish, legumes, and leafy green vegetables, is recommended. Complementary strategies include enhancing iron absorption by consuming foods rich in vitamin C, such as citrus fruits, while avoiding inhibitors like tea, coffee, and calcium-rich foods during meals. In low-resource settings, food fortification with iron is a practical approach to addressing widespread deficiencies. Programs that provide iron-fortified cereals, flours, or salt have shown promise in reducing IDA prevalence among pregnant women.[33]

2. Iron Supplementation

Oral iron supplementation is the first-line treatment for IDA in pregnancy. Ferrous sulfate, ferrous gluconate, and ferrous fumarate are commonly prescribed, delivering 30-120 mg of elemental iron daily. To enhance absorption and minimize gastrointestinal side effects, supplementation is often taken with vitamin C or between meals. Newer formulations, such as liposomal iron and heme-based iron supplements, offer improved tolerability and efficacy. For women with severe anemia or poor response to oral therapy, intravenous iron formulations, such as ferric carboxymaltose or iron sucrose, provide a rapid and effective alternative.[34]

3. Folic Acid and Multinutrient Supplementation

Since IDA often coexists with other micronutrient deficiencies, such as folate and vitamin B12, combining iron with a multivitamin supplement is advisable. Folic acid supplementation (400-600 µg/day) is particularly crucial during pregnancy to prevent neural tube defects in the fetus while supporting hematopoiesis. Prenatal supplements that include additional nutrients, such as zinc and vitamin A, may offer comprehensive benefits for both maternal and fetal health.[35]

4. Blood Transfusion

In cases of severe anemia (hemoglobin <7 g/dL) with imminent risks to maternal or fetal health,

blood transfusions are a life-saving intervention. Transfusion rapidly restores oxygen-carrying capacity and stabilizes critical patients. However, it is used sparingly due to risks such as transfusion reactions, infections, and alloimmunization. Ensuring the availability of safe blood and appropriate crossmatching practices is essential for effective transfusion management.[36]

5. Management of Underlying Causes

Addressing the root causes of IDA is integral to its management. Infections such as malaria, hookworm, or schistosomiasis, which contribute to iron depletion, must be treated concurrently. Antiparasitic medications, along with preventive measures like deworming and use of insecticide-treated nets, play a critical role in reducing recurrent anemia. Similarly, managing chronic inflammatory conditions that impair iron utilization is essential for sustaining treatment efficacy.[32]

6. Public Health Interventions

At the population level, public health initiatives aimed at improving maternal nutrition and anemia awareness are vital. Community-based education programs emphasize the importance of prenatal care, dietary modifications, and adherence to iron supplementation. Regular anemia screening during antenatal visits allows for early detection and intervention. Policymakers should prioritize equitable access to iron supplements and healthcare services, especially in low-resource settings where anemia rates are highest.[33]

7. Emerging Therapies

Research into novel therapies for IDA in pregnancy is expanding. Hepcidin antagonists, erythropoiesis-stimulating agents, and iron nanoparticles represent emerging options that may overcome limitations of current treatments. For instance, hepcidin inhibitors could enhance iron absorption and mobilization in patients with concurrent inflammation or chronic disease. These innovations, coupled with advancements in diagnostic precision, could revolutionize the management of IDA in the future.[34-35]

8. Monitoring and Follow-up

Effective management of IDA requires regular monitoring to assess treatment response and ensure maternal and fetal safety. Hemoglobin levels are typically re-evaluated 4-6 weeks after initiating treatment, with adjustments made based on clinical progress. Long-term follow-up ensures sustained improvement in iron status and prevents relapse, particularly in women with repeated pregnancies or chronic conditions.[36]

Conclusion

Iron deficiency anemia (IDA) in pregnancy remains a significant public health challenge due to its profound impact on maternal and fetal outcomes. The condition contributes to adverse maternal effects, including fatigue, reduced work capacity, and increased risks of preterm labor and postpartum hemorrhage, while also being strongly associated with fetal complications such as intrauterine growth restriction, low birth weight, preterm delivery, and impaired neurodevelopment. Addressing IDA is essential not only for optimizing pregnancy outcomes but also for promoting the lifelong health and development of the offspring. Effective management strategies for IDA involve a multifaceted approach, combining nutritional interventions, iron supplementation, and treatment of underlying causes with advanced therapies and robust public health initiatives. Early diagnosis through integrated screening protocols and targeted therapies tailored to individual needs is crucial for timely intervention. Public health programs that focus on education, equitable access to resources, and food fortification play a pivotal role in reducing the global burden of IDA, particularly in resource-limited settings.

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.

Access this Article in Online	
	Website: www.ijcrcps.com
Quick Response Code	Subject: Haematology
DOI: 10.22192/ijcrcps.2024.11.11.005	

How to cite this article:
Emmanuel Ifeanyi Obeagu. (2024). Iron Deficiency Anemia: Maternal and Fetal Outcomes in Pregnancy. Int. J. Curr. Res. Chem. Pharm. Sci. 11(11): 26-34.
DOI: http://dx.doi.org/10.22192/ijcrcps.2024.11.11.005

