MedCrave
Step into the World of Research

Hematology & Transfusion International Journal

Review Article

Open Access

CrossMark

A review on anaemia in pregnancy

Abstract

The normal physiological change of an increase in plasma volume causes hemodilution in a pregnant woman. Haemoglobin deficiency can be caused either by decreased amount of haemoglobin molecules as in anaemia. Haemoglobin deficiency decreases blood-oxygen carrying capacity. Anaemia in pregnancy is an important public health problem worldwide. WHO estimates that more than half of pregnant women in the world have a haemoglobin level indicative of anaemia. In women, during their reproductive years, the iron losses are compounded by menses. Although the blood loss is relatively constant in successive periods, the individual variation among women is large. Iron sufficient women lose an average of 25-45ml of blood through menses which approximates to 0.7-1.4mg/day in terms of iron loss. A menstrual blood loss of 50-60ml seems to be the upper limit of normal, since women whose losses have exceeded this limit eventually develop Iron Deficiency Anaemia.

Keywords: haemoglobin, anaemia, pregnancy, TBH, CDC, UNTH, PCV

Volume 6 Issue 3 - 2018

Obeagu Emmanuel Ifeanyi,[1] Obeagu Getrude Uzoma[2]

[1]Department of University Health Services, Michael Okpara University of Agriculture, Nigeria

[2]Department of Nursing Science, Ebonyi State University, Nigeria

Correspondence: Obeagu Emmanuel Ifeanyi, Diagnostic Laboratory Unit, Department of University Health Services, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria, Email emmanuelobeagu@yahoo.com

Received: March 16, 2018 | **Published:** June 11, 2018

Introduction

Haemoglobin concentration in pregnancy

The normal physiological change of an increase in plasma volume causes hemodilution in a pregnant woman. Although the red cell mass increases, plasma volume increases disproportionately, resulting in a lowering of haemoglobin (Hb) to approximately 11.5g/dl. Haemoglobin is the iron-containing oxygen-transport metalloprotein in the red blood cells of all vertebrates (1), with the exception of fish family. In humans, the protein makes up about 96% of the red blood cells dry content by weight and around 35% of the total content.[1] Haemoglobin has an oxygen-binding capacity of 1.34ml oxygen per gram.[2] The human haemoglobin molecule can carry up to four oxygen molecules.[3] Haemoglobin consists mostly of the protein subunits, the globin molecules, and these proteins are folded chain of a large number of different amino acids called polypeptides. There is more than one haemoglobin gene. The amino acid sequences of the globin proteins in haemoglobin usually differ between species. These differences grow larger between less closely related species.[3]

Mutations in the genes for the haemoglobin protein in a species result in haemoglobin variant.[4] Many of these mutant forms of haemoglobin cause no disease. Some of these mutant forms of haemoglobin, however, cause a group of hereditary diseases termed the hemoglobinopathies, the best known is sickle cell anaemia.[4]

A separate set of diseases called thalassaemias involves underproduction of normal and sometime abnormal hemoglobins. All these diseases produce anaemia. Haemoglobin deficiency can be caused either by decreased amount of haemoglobin molecules as in anaemia or by decreased ability of each molecule to bind oxygen at the same partial pressure of oxygen. Haemoglobin deficiency decreases blood-oxygen carrying capacity. Among the causes of low haemoglobin are loss of blood, nutritional deficiency, bone marrow problems, chemotherapy, kidney failure and abnormal haemoglobin such as that of sickle-cell disease. Decrease in haemoglobin with or without an absolute decrease of red blood cells, leads to symptoms of anaemia. Anaemia has many causes although iron deficiency and its resultant iron–deficiency anaemia are the most common causes.[2]

Anaemia in pregnancy

Anaemia in pregnancy is an important public health problem worldwide. WHO estimates that more than half of pregnant women in the world have a haemoglobin level indicative of anaemia (i.e., <11.0g/dl). The prevalence in developing countries can be as high as 56 or 61%,[5] with a high incidence and severity occurring in primigravidae in malaria endemic areas.[6] Due to the physiological burden of pregnancy, pregnant women often become anaemic during pregnancy because of the increased demand for iron and other vitamins. The inability to meet the required level for these substances, either as a result of dietary deficiencies or infections, gives rise to anaemia.[7]

Anaemia ranges from mild, moderate to severe and WHO pegs the haemoglobin level for each of these types of anaemia in pregnancy at 10.0-10.9g/dl (mild); 7-9.9g/dl (moderate) and 7g/dl (severe anaemia). Studies in Nigeria have shown that malaria is still a major problem among pregnant women (8) and malaria is known to cause anaemia. In pregnancy, anaemia has a significant impact on the foetus as well as that of the mother. 20% of maternal deaths in Africa have been attributed to anaemia.[8] Foetuses are at risk of preterm deliveries, low birth weights, morbidity and perinatal mortality due to the impairment of oxygen delivery to the placenta and foetus. It is believed that the provision of adequate statistics would help in the management and control of anaemia in pregnant women especially in developing countries.[8]

In Abeokuta, a study was conducted by Idowu et al.,[9] to survey anaemia in pregnant women. The study was carried out to determine the prevalence of anaemia among pregnant women receiving antenatal care in two hospitals and a traditional birth home (BTH). They used packed cell volume to assess anaemia and questionnaires to obtain demographic information. Four hundred and seventy women were enrolled in the study; 155 women were primigravidae and 322 were multigravidae. They recorded 365 (76.5%) pregnant women who had

anaemia at one trimester or other. Of these, 125 were primigravidae constituting a prevalence of 80.6% and 74.5% anaemia among primigravidae and multigravidae respectively. They also found that anaemia was higher among women in the TBH (81.4%) than those in the hospitals (72.5%). They identified from their study stated from their study that primigravidae women are at risk of severe anaemia than multigravidae. They also stated that women using Traditional birth centre (TBH) for antenatal care, pregnant teenagers and women that book late for antenatal care are at risk of severe anaemia.

A study was conducted by Morrison & Parrish[10] to evaluate pregnancy associated anaemia. Morrison and Parrish stressed that anaemia during pregnancy is more likely to be labeled as normal since hemodilution takes place during the first and second trimester. "It is frequently described as physiologic," they said, which again serves to disabuse health care providers as well as patients and their families from the notion that anaemia during gestation is abnormal. They noted that on the other hand, pregnant women with even mild anaemia have increased perinatal mortality and early neonatal mortality largely associated with preterm and growth restriction.[11] 20% of women with normal haemoglobin values in the last trimester of pregnancy were discovered to have anaemia at their first postpartum visit.[12] Among low income women, the centers for disease control and prevention (CDC) found the prevalence of anaemia to increase with gestation, noting 8%, 12% and 29% in the first, second and third trimester respectively.[13] Additionally, there is a real risk of transfusion, particularly among patients who have cesarean delivery. More than a third (36%) of these women with a preoperative haematocrit of 25% or less required a postoperative blood transfusion.[14]

Alem et al.,[15] conducted a study to assess the prevalence of anaemia and associated risk factors among women attending antenatal care in Azezo health centre, Gordan Town, Northwest Ethiopia. They assessed red cell morphology, Haemoglobin level and intestinal parasites following standard procedures. From their results, of the 384 study participants, the prevalence of anaemia was 83(21.6%). Over half (68.4%) of the pregnant women attended antenatal care in the second trimester (between 13 and 28weeks).The majority of anaemic cases 49 % (41/83) were of the mild type (Haemoglobin 10.0–10.9g/d1) followed by 46% cases of moderate anaemia (7–9.9g/dl) and 5% severe anaemia (Haemoglobin<7g/dl). Pregnant women with age>34, rural residence, history of malaria attack, hookworm infection and absence of iron supplements are significantly associated with increased risk of anaemia. The most prevalent intestinal parasite among pregnant women was hookworm 18 (4.7%). They concluded that the prevalence of anaemia was low when compared with the previous studies carried out in different countries including Ethiopia. They suggested that more should be done in respect to the importance of regular visit to maternal care centers and health education promotion programs to succeed more.

Dim & Onah[16] conducted a study to determine the prevalence of anaemia among pregnant women at booking in Enugu, South Eastern Nigeria. Their aim was to determine the prevalence of anaemia among pregnant women at registration for antenatal care at a major tertiary healthcare center in Enugu, southeastern Nigeria. This was a retrospective study of 530 normal pregnant women registered with the antenatal unit of the University of Nigeria Teaching Hospital (UNTH), Enugu, between January 1, 2005 and October 30, 2005. Data on the age, parity, gestational age at booking, interval between last confinement and last menstrual period in the index pregnancy, haemoglobin concentration at booking, and HIV status were obtained and analyzed.

From their results the mean gestational age at booking was 21.7±7.1 weeks (range, 6-37). Two hundred fourteen (40.4%) of the women were anaemic (haemoglobin [Hb]<11.0g/dL). The majority (90.7%) of these anaemic patients were mildly anaemic, whereas 9.3% were moderately anaemic. There was no case of severe anaemia (Hb<7.0g/dL). The prevalence of anaemia at booking was significantly higher in those who registered for antenatal care in the third trimester than in those who registered in the second trimester, and in HIV-positive pregnant women than in HIV-negative ones (P=.00). The patients' age, parity, and the interval between the last confinement and the index pregnancy had no significant relationship with the haemoglobin concentration of pregnant women at booking (P>.05). They concluded that the prevalence of anaemia in pregnancy at booking is still high in Enugu. Preconception care, including iron and folic acid supplementation, is advocated to reduce this problem. Early antenatal booking and improved antenatal care are also necessary for early diagnosis and treatment of the condition. All would ensure safe motherhood.

Olubukola et al.,[17] conducted a study at two levels of health care in Ibadan, south west Nigeria to assess anaemia in pregnancy. Their study was a retrospective study of the booking records of pregnant women at the University College Hospital (UCH, a profit-making tertiary institution) and Adeoyo Maternity Hospital (AMH, a secondary level institution offering free services) in Ibadan, September 1, 2008 to December 31, 2008. Eligible women had singleton pregnancies and no known chronic illnesses. Anaemia was defined as packed cell volume (PCV) <30%, and degrees of anaemia as mild (PCV 27-29%), moderate (PCV 19-26%), and severe (PCV below 19%). Statistical analysis was done by the Chi-square test, Fisher exact test, and t-test. A P value of <0.05 was considered significant. From their study, data from 2702 women (384 and 2318 from UCH and AMH, respectively) were available for analysis. About 30% of the women were anaemic. The patients in UCH had higher mean PCV (33.03±4.32 vs. 31. 04±4.09, P=0.00). A higher proportion of anaemia was seen in patients presenting in Adeoyo (32.4% vs. 16.7%, P=0.00). Factors associated with anaemia included young age (P=0.00), low parity (P=0.00), and hospital type (P=0.00). Parity and hospital type remained significant on logistic regression. Their conclusion was lower prevalence of anaemia at the tertiary hospital maybe attributed to the higher socioeconomic status of the clientele. They advocated short-term early antenatal management of anaemia and long-term economic/educational empowerment.

Abidoye et al.,[18] conducted a study of incidence of anaemia in pregnant women and the control in Port Harcourt, Nigeria. A total of 200 women were involved in the study–100 pregnant women on routine antenatal visit to the Health Centre and the remaining 100 non-pregnant women who visited the Planned Parenthood Federation of Nigeria Clinic for family planning purposes. The prevalence of anaemia in pregnancy was found to be 31%. There was a statistically significant difference in the pregnant and non-pregnant. More anaemic pregnant than non-pregnant while anaemia was found highest in the third trimester. No statistical significant difference between parity in anaemia but anaemia was higher in multiparous expectant mothers than primigravidae. The mean haemoglobin level of pregnant women was found to be 11.49gm%.

Iron deficiency anaemia and anaemia due to acute blood loss

To understand iron deficiency anaemia in pregnancy, a look at iron homeostasis is important. The conservation of iron in humans is

tenacious with 0.1% of the total amount of body iron lost each day. This amount is easily replaced in non-pregnant adult if the dietary source is adequate. The average amount of iron excreted by the adult is about 0.9mg/day with most being lost in the intestinal tract as desquamated gastrointestinal cells, blood and bile.[10] Additionally, epidermal loss and sweat produce a daily iron loss of 0.2mg. In areas of high temperature and humidity, an additional 0.5mg/day may be lost, but the loss rarely produces iron deficiency anaemia. Finally, a small amount (0.1mg) of iron is excreted daily in urine. Both sexes lose a similar amount of iron through these mechanisms.[10]

In women, during their reproductive years, the iron losses are compounded by menses. Although the blood loss is relatively constant in successive periods, the individual variation among women is large. Iron sufficient women lose an average of 25-45ml of blood through menses which approximates to 0.7-1.4mg/day in terms of iron loss. A menstrual blood loss of 50-60ml seems to be the upper limit of normal, since women whose losses have exceeded this limit eventually develop Iron Deficiency Anaemia.[10] Pregnancy has a marked effect on iron homeostasis. In healthy menstruating women, the loss of 2mg/day can be overcome by a daily food intake of 1800-2200 calories, which contain 11-13mg of iron. However even in an iron-sufficient state, large amounts of iron must be borrowed from iron stores to complete a pregnancy.[10] During the first half of pregnancy, iron requirements are not increased; the absence of menses, an intake of 11-13mg/day is adequate. After the 20th week, however, the RBC mass begins to expand and the foetus requires more iron. Even with increased absorption, the amount of dietary iron is not adequate to prevent a reduction in iron stores. If the dietary iron is not enough, storage iron must supply the needs.[10]

Iron absorption increases from 10% during the first trimester to 30% during the latter half of pregnancy. Iron acquired from diet alone is not enough and must be supplied by storage iron. In women who are deficient in storage iron prior to pregnancy; this further requirement may lead to overt iron deficiency anaemia. It should be noted also that if the storage iron is insufficient at the beginning of pregnancy, the maternal haemoglobin mass will not be expanded until the foetal demands are met.[10]

Anaemias due to acute blood loss in pregnancy

Anaemias resulting from acute blood loss during pregnancy usually have evident aetiologies, since external blood loss usually occurs and symptoms are sudden. These disorders can include multiple trauma and spontaneous splenic rupture, as well as disorders of gastrointestinal, pulmonary or urinary tract, which may or may not be related to obstetric conditions.

Packed cell volume

Packed cell Volume or haematocrit also called erythrocyte volume fraction (EVF) is the volume percentage of red blood cells in blood.[19] It is considered an integral part of a person's complete blood count, along with haemoglobin concentration, white cell count and platelet count. It can be used to define anaemia. Anaemia refers to abnormally low haematocrit.[19] For a condition such as anaemia that can go unnoticed, one way it can be diagnosed is by measuring the haematocrit level in the blood.[19] Among the conditions that can result in lowered haematocrit levels is pregnancy in which there is haemodilution.[20]

Wahed et al.,[20] conducted a cross-sectional study to verify the fact of low haemoglobin and packed cell volume I pregnant women. They found out that percentage haemoglobin and packed cell volume were significantly decreased in the second and third trimester of pregnancy for women not on supplements. It is evident from their study that the significantly low Hb and PCV in pregnant women are due to dietary iron deficiency. They concluded that iron therapy in pregnant women is helpful to maintain %Hb and PCV nearer to that of non-pregnant and normal women.[20]

Verma & Chaudhary[21] conducted a study of haematological parameters in advanced pregnancy. Among the parameters were Hb and PCV; others were RBC WBC< ESR and blood indices. The relationship between these parameters and the maternal age, parity, diet and gestational age was evaluated. The aims of their study were to study the haematological parameters during pregnancy, to differentiate physiological from pathological anaemia on the basis of these parameters and to study the prevalence of anaemia in women during the last trimester of pregnancy. Their results showed that haematological changes in pregnancy are in response to the rapidly growing foetus, placenta and their increasing demands with increase in maternal oxygen consumption, cardiac output and blood volume. They found there were increase in RBC production and so also an increase in HB and PCV. But due to the presence of hemodilutional factor in pregnancy, Hb concentration, RBC count and PCV appears to be less compared to non-pregnant females.[21] In their conclusion, they stated that anaemia was common in pregnant women below 20 years of age and above 30 years of age. They observed that mean haemoglobin level was inversely proportional to parity. Their study revealed high ESR and neutrophilic leukocytosis suggesting bone marrow hyperplasia due to increased level of erythropoietin.

Conclusion

The normal physiological change of an increase in plasma volume causes hemodilution in a pregnant woman. Haemoglobin deficiency can be caused either by decreased amount of haemoglobin molecules as in anaemia or by decreased ability of each molecule to bind oxygen at the same partial pressure of oxygen. Haemoglobin deficiency decreases blood-oxygen carrying capacity. Anaemia in pregnancy is an important public health problem worldwide. In women, during their reproductive years, the iron losses are compounded by menses. Although the blood loss is relatively constant in successive periods, the individual variation among women is large. Iron sufficient women lose an average of 25-45ml of blood through menses which approximates to 0.7-1.4mg/day in terms of iron loss. It is recommended that prevention of anaemia in pregnancy is important by maintaining good nutritional status and attending regular antenatal cares. Early detection of anaemia is crucial and prompt management established to avert any associated complications of anaemia in pregnancy.

Acknowledgements

None.

Conflict of interest

Author declares that there is no conflict of interest.

References

1. Weed RI, Reed CF, Berg G. Is haemoglobin an essential structural component of human erythrocyte membranes? *J Clin Invest.* 1963;42(4):581–588.

2. Dominguez de Villota ED, Ruiz Carmona MT, Rubio JJ, et al. Equality of the in vivo and in-vitro oxygen-binding capacity of haemoglobin in patients with severe respiratory disease. *Br J Anaesth.* 1981;53(12):1325–1328.
3. Costanzo LS. *Physiology.* In: Hagerstwom, editor. Lippincott Williams &Wilkins; 2007.
4. A syllabus of Human Haemoglobin Variants (1996) Globin. 2013.
5. WHO. *Management of Severe anaemia in pregnancy: report of a technical working group.* Geneva; 1994.
6. Matteelli A, Donato F, Shein A, et al. Malaria and anaemia in pregnant women in urban Zanzbar Tanzania. *Ann Trop Med Parasitol.* 1994;88(5):475–483.
7. Van den Broek N. The aetiology of anaemia in pregnancy in West African. *Trop Doct.* 1996;26(1):5–7.
8. Harrison KA. Maternal mortality and anaemia in pregnancy. *W Afr Med J.* 1975;23:27–31.
9. Idowu OA, Mafiana CF, Dapo S. Anaemia in Pregnancy: A survey of pregnant women in Abeokuta, Nigeria. *Afr Health Sci.* 2005;5(4):295–299.
10. Morrison JC, Parrish MR. *Glob Libr Women's Med*. 2011.
11. Little MP, Brocard P, Elliott P, et al. Haemoglobin concentration in pregnancy and perinatal mortality: A London-based Cohort Study. *Am J Obstet Gynecol.* 2005;193(1):220–226.
12. Bodnar LM, Scanlon KS, Freedman DS, et al. High prevalence of postpartum anaemia among low-income women in the United States. *Am J Obstet Gynecol.* 2001;185(2):438–443.
13. Centres for disease Control and Prevention. *Pregnancy Nutrition surveillance, 1996 full report*. Atlanta: US department of health and human services; 1998.
14. Rouse DJ, MacPherson C, Landon M, et al. Blood transfusion and cesarean delivery. *Obstet Gynecol.* 2006;108(4):891–897.
15. Alem M, Enawgaw B, Gelaw A, et al. Prevalence of anaemia and associated risk factors among pregnant women attending antenatal care in Azezo Health Center Gondar town, Northwest Ethiopia. *J Interdiscipl Histopathol.* 2013;1(3):137–144.
16. Dim CC, Onah HE. The Prevalence of Anaemia Among Pregnant Women at Booking in Enugu, South Eastern Nigeria. *MedGenMed.* 2007;9(3):11.
17. Olubukola A, Odunayo A, Adesina O. Anaemia in pregnancy at two levels of health care in Ibadan, south west Nigeria. *Ann Afr Med.* 2011;10(4):272–277.
18. Abidoye RO, Hunponu-Wusu OO, Martyns-Yellowe TI. A study of incidence of anaemia in pregnant women and the control in Port Harcourt, Nigeria. *Early Child Development and Care.* 1992;79(1):89–96.
19. Purves WK, Sadava D, Orians GH. Life: The science of Biology. 7th ed. Sunderland Mass: Sinaeur Associates; 2004. 954 p.
20. Wahed F, Latif S, Uddin M , et al. Fact of low haemoglobin and packed cell volume in pregnant women at a standstill. *Mymensingh Med J.* 2008;17(1):4–7.
21. Verma A, Chaudhary H. Study of haematological parameters in advanced pregnancy. *International Journal of Recent Trends in Science And Technology.* 2013;7(1):16–19.