Review Article

Iron Deficiency Anemia in Pregnancy in Nigeria—A Systematic Review

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ABSTRACT

Anemia in pregnancy is a public health problem in Nigeria and it is more than likely that iron deficiency is the major cause. This study aimed to review relevant publications in order to summarize the prevalence of iron deficiency anemia, risk factors associated with iron deficiency, anemia in pregnancy as well as factors associated with compliance to routine iron therapy. MEDLINE Entrez PubMed search was performed in August 2017 and studies that investigated iron deficiency anemia in pregnancy in Nigeria from 1968 to 2017 were sought. Search keywords included "iron deficiency anemia, pregnancy, Nigeria." Only studies that provided information on the prevalence of iron deficiency anemia, risk factors associated with iron deficiency anemia and risk factors associated with compliance to routine iron therapy in pregnancy in Nigeria were eligible and were selected. Inclusion criteria were original scientific investigations, not reviews, studies conducted in Nigeria between 1968 and 2017 and studies written in the English language. A total of six relevant studies that fulfilled the study inclusion criteria were identified out of 36 studies found. All the studies reported a high prevalence of iron deficiency anemia among pregnant women and risk factors associated with iron deficiency anemia in pregnancy include multiparity, third trimester of pregnancy, and low socioeconomic status. Risk factors associated with noncompliance to routine iron therapy include poor utilization of antenatal services, low educational attainment, distance to a health facility, single or teenage pregnancy, increasing age of the pregnant women, and living in the rural areas. The prevalence of iron deficiency anemia among pregnant women was reported to be high. Awareness creation and education on the importance of family planning and proper utilization of antenatal care services should be encouraged. There should be economic empowerment of women, provision of health facilities to areas where they are absent to encourage early booking and utilization of antenatal care services.

KEYWORDS: *Anemia, iron deficiency, pregnancy*

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INTRODUCTION

Anemia is the commonest hematologic disorder that occurs in pregnancy and is a public health problem particularly in most of the developing countries, as it significantly contributes to an increase in maternal and perinatal morbidity and mortality.[1] It is a condition of low circulating hemoglobin (Hb) in which concentration has fallen below a threshold lying at two standard deviations below the median of a healthy population of the same age, sex, and stage of pregnancy causing decreased oxygen-carrying capacity in a pregnant woman.[2] This reduced oxygen-carrying capacity results in reduced oxygen supply both to the mother and the developing baby. In developing countries, it is a cause of serious concern as, besides many other adverse effects on the mother and the fetus, it contributes significantly to high maternal mortality.[3] It increases the risk of preterm delivery and postpartum maternal

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infections.[4] Globally, more than 2 billion people suffer from anemia; the most common cause being an iron deficiency.[5] While WHO defines anemia in pregnancy as hemoglobin level of less than 11 g/dL (or hematocrit less than 33%),[6] value of less than 10 g/dL is commonly used in developing countries including Nigeria.[7] It has been shown that no significant harm is encountered in the fetus until the hemoglobin concentration drops to less than 10 g/dL. The Center for Disease Control uses hemoglobin concentration of less than 11 g/dL in first and third trimesters and hemoglobin concentration less than 10.5 g/dL in the second trimester.[8]

Anemia is underreported in most developing countries even though it is one of the most prevalent public health problems and has serious consequences for national development.[9] Iron deficiency causes approximately 50% of all anemia (but the proportion varies among population groups and in different areas), and almost a million deaths a year; three-quarters of the deaths occur in Africa and Southeast Asia.[10,11] Although more prevalent in less-resourced countries, women from developed countries are also affected. Women from both rural and urban areas are vulnerable.[12] A large number of women from less-resourced countries embark upon pregnancy with frank iron deficiency anemia and/or depleted iron stores. Anemia is the major contributory or sole cause in 20–40% of maternal deaths.[13]

Iron deficiency is the most common nutritional deficiency in the world and accounts for 75% of all types of anemia in pregnancy.[6] It is due to the fact that diet in pregnancy is insufficient to supply iron requirements. It has a high prevalence in developing countries, but it is also relevant in developed countries where other nutritional disorders have been almost eliminated. The cause of iron deficiency anemia is usually inadequate dietary intake (especially in adolescent girls), a previous pregnancy, and normal recurrent loss of iron in menstrual blood (which approximates the amount normally ingested each month and, thus, prevents iron stores from building up).[6]

During pregnancy, there is a physiological hemodilution, with a peak during 20–24 weeks of gestation.[14] It is well established that there is a physiological drop in hemoglobin in the mid-trimester. This physiological drop is due to the higher increase in plasma volume (50%), compared with red blood cell mass (30%) during pregnancy. This physiological process produces relative hemodilution, helping the blood circulation in the placenta.[15] In addition, during pregnancy, iron deficiency is relatively common because of the increased iron demand with a mean iron requirement of 4.4 mg/day.[16] Because many women start pregnancy with poor or depleted iron stores, the amount of iron absorbed from the diet, together with that mobilized from stores, is usually insufficient to meet the maternal demands imposed by pregnancy.[16]

Nigeria has a high maternal mortality rate and anemia is a major contributor. Iron deficiency is the commonest cause of anemia in pregnancy.[17] Various studies have assessed the prevalence and risk factors associated with iron deficiency anemia in pregnancy in Nigeria but none has systematically summarized such studies.[3,12] The aim of this review was to summaries the prevalence of iron deficiency anemia in pregnancy in Nigeria and to identify the factors associated with iron deficiency anemia as well as factors associated with compliance to routine iron therapy.

Materials and Methods

A MEDLINE Entrez PubMed search was performed in August 2017 and studies published in English which investigated iron deficiency anemia in pregnancy in Nigeria, risk factors associated with iron deficiency anemia as well as factors associated with compliance to routine iron therapy were sought. PubMed was searched for studies from Nigeria undertaken from 1968 to 2017. The following were the search strategies/keywords used: "*iron deficiency anaemia, pregnancy, Nigeria,*" which yielded 36 publications as in August 2017.

All the publications (36) found were subjected to the study inclusion criteria in order to select the publications which addressed the issue in question as well as met the study objectives. The following study inclusion criteria were used: i) studies conducted in Nigeria between 1968 and 2017. ii) Original scientific investigations, not reviews. iii) Studies conducted which determined the prevalence of iron deficiency anemia in pregnancy, risk factors associated with iron deficiency anemia as well as factors associated with compliance to routine iron therapy. iv) Studies written in the English language. Studies that did not meet these criteria were excluded. Following these processes, six publications were noted to have met the study inclusion criteria and were selected for the review [Figure 1].

Subsequently, the references of all the resulting six publications were hand-searched for additional studies and information relevant to the review. Publications that did not completely fulfill the study inclusion criteria but adjudged to contain vital information necessary for the narrative aspect of the review were selected and used accordingly. The selected publications were then grouped according to the following: author(s)/year of publication, a state where the research took place, study design, evidence generated/outcome from the

study, and policy implication of the study including the recommendations.

Results

The six studies identified to have met the study inclusion criteria were used for this review. The outcomes of the review are presented in this chapter using tables. For the purpose of ease of presentation and discussion, the publications were categorized into two according to the health issue addressed in the study [Tables 1 and 2].

Prevalence and risk factors for iron deficiency anemia in pregnancy

From the search, three out of the six scientific publications (50%) retrieved reported on the prevalence and/or risk factors associated with iron deficiency anemia in pregnancy [Table 1]. The prevalence of iron deficiency anemia was reported to be high, ranging from 25% to 45.6%. Risk factors associated with iron deficiency anemia include multiparity, third trimester of pregnancy, low educational level, and low economic status [Table 1].

Table 1: Profile and characteristics of scientific publications that assessed the prevalence and risk factors associated with iron deficiency anemia in pregnancy

Author/year of publication	Location/state	Study design	Evidence generated/outcome	Policy implication/recommendations
Isah *et al*., 1985	Zaria, Kaduna State	Cross-sectional study	Iron deficiency anemia (IDA) in 30% out of 27 pregnant elite and 25% out of 68 pregnant non-elite using serum iron, iron-binding capacity, serum ferritin, transferrin saturation, and free erythrocyte protoporphyrin. Risk factors for IDA include increasing parity, third trimester of pregnancy.	Iron supplements in pregnancy irrespective of socioeconomic status or maternal parity.
Obasi and Nwachukwu, 2013	Abakaliki Ebonyi State	Cross-sectional study	Out of 307 pregnant women, 45.6% was reported to have IDA using serum iron level and hemoglobin concentration. Risk factors for IDA include parity, low educational level, occupation, living accommodation, economic status.	Family planning, women education, and economic empowerment of women.
Okafor *et al*., 2017	Calabar, Cross River State	Cross-sectional study	IDA is commoner among pregnant women from two rural communities 32% (16 out of 50) and 12% (6 out of 50) than those in Urban area 10%. (7 out of 70) using serum iron, total iron-binding capacity, transferrin saturation, serum ferritin, soluble transferrin receptor, soluble receptor/ferritin ratio. Risk factors include third trimester of pregnancy and multiparity.	Institution and implementation of family planning and improved nutrition.

Table 2: Profile and characteristics of scientific publications on factors associated with compliance to routine iron therapy

Author/year of publication	Location/state	Study design	Evidence generated/outcome	Policy implication/recommendations
Onyeneho *et al*., 2016	Enugu and Imo State	Cross-sectional, focus group discussion, and in-depth interviews	Compliance with routine iron therapy is enhanced by higher level of education, closeness to health facility, and utilization of antenatal care services	Health education on the importance of compliance with routine iron therapy. Government to make health facilities more accessible to pregnant women.
Dairo and Lawovin, 2006	Oyo State	Cross-sectional descriptive	Compliance rate was 37.5%. Prevalence of anemia was higher among noncompliant women than those complying (18% vs 15%), factors associated with noncompliance to routine iron therapy include single and teenage mothers, age above 35 years, living in rural area.	Education and women empowerment. Prophylactic administration of parenteral iron (total dose infusion) in pregnancy.
Adanikin *et al*., 2015	Ado-Ekiti, Ekiti State	Observational study	Iron supplementation compliance rate was 184 (72.2%). Compliance was associated with higher hemoglobin level.	Education and prophylactic administration of parenteral iron (total dose infusion) in pregnancy.

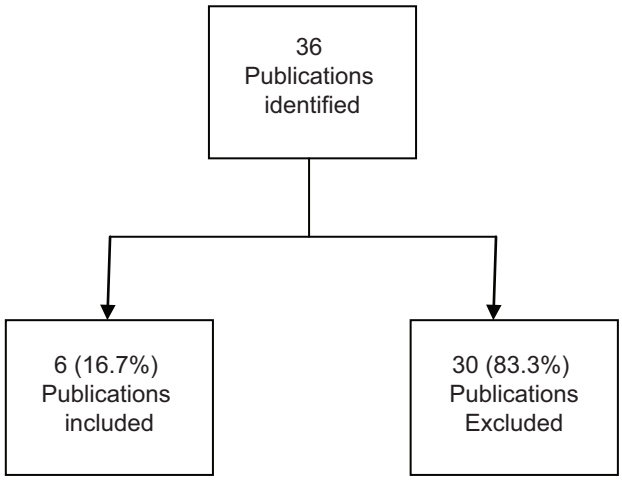

Figure 1: Flowchart of publication identification and selection process

Factors associated with compliance with routine iron therapy

Table 2 presents three (50%) out of the six identified scientific publications (Onyeneho *et al*., 2016; Dairo and Lawovin, 2006; Adanikin *et al*., 2015) that reported on the risk factors associated with poor compliance with routine iron therapy. Risk factors reported include poor utilization of antenatal care services, low educational attainment, distance to a health facility, single and teenage pregnancy, and age of the pregnant woman [Table 2].

Discussion

The findings of this review showed that there is a high prevalence of iron deficiency anemia among pregnant women in Nigeria. All the studies reviewed reported certain risk factors associated with iron deficiency anemia in pregnancy. Out of the total of 36 publications found from the MEDLINE search related to iron deficiency anemia in pregnancy in Nigeria, only six (16.7%) fulfilled the inclusion criteria. The implication of this finding suggests that an inadequate amount of research relevant to iron deficiency anemia in pregnancy has been undertaken in Nigeria. This may be due to less attention given to nutrition in pregnancy.

Maternal mortality ratio (MMR) remains high in Nigeria and other countries in sub-Saharan Africa despite a substantial reduction in global trends of maternal deaths.[18] Anemia has been implicated as a major contributor to the high maternal mortality rate in Nigeria and other developing countries.[19-21] The prevalence of anemia in pregnancy varies considerably because of the differences in socioeconomic conditions, lifestyles, and health-seeking behaviors across different cultures.[22] Anemia in pregnancy is a common problem in Nigeria with iron deficiency anemia as the commonest cause.[23] This review has shown evidence that the prevalence of iron deficiency anemia among pregnant women in Nigeria is still high, ranging from 25% to 45.6%.[12,24,25] Nutritional deficiencies resulting in anemia are often worsened by the additional nutrient demands associated with fetal growth.

Risk factors associated with iron deficiency anemia in pregnancy include multiparity, third trimester of pregnancy, and low socioeconomic status (low educational attainment, no occupation, poor living condition). According to Okafor *et al*. and Isah *et al*., multiparity is an important risk factor associated with iron deficiency anemia.[26,27] Pregnancy consumes a lot of iron, hence, too frequent pregnancies within short intervals will result in iron deficiency.[28] The gestational iron demand is 3–4 folds the requirement of the nonpregnant women.[29] Although it can be mobilized from the maternal stores to meet this requirement, women in general, are found to have low iron stores probably due to the monthly loss of blood in menstruation.[30] Once these stores are depleted, the mother will develop iron deficiency.[31] A deficiency of iron causes a reduction in the rate of hemoglobin synthesis and can result in iron-deficiency anemia.[32] Reducing the total number of pregnancies, and increasing the time interval between pregnancies will contribute to the control of iron deficiency anemia in women. Family planning and child spacing will reduce iron demand in the woman with resultant prevention of iron depletion, iron deficiency anemia, and its consequences.

Another risk factor reported to be associated with iron deficiency anemia in pregnancy is the third trimester of pregnancy.[26,27] During pregnancy, there is an increase in both red cell mass and plasma volume to accommodate the needs of the growing uterus and fetus. The plasma volume increases more than the red cell mass leading to a fall in the concentration of hemoglobin in the blood.[33] This drop in hemoglobin concentration decreases the blood viscosity and this enhances the placental perfusion providing a better maternal-fetal gas and nutrient exchange.[34] This physiological process occurs as the pregnancy progresses and utilizes iron, further worsening the anemia in the third trimester of pregnancy. The dilution of blood in pregnancy is a natural process and starts approximately at the 8th week of pregnancy and progresses until the 32nd to 34th week of pregnancy.[35] In addition, there is a marked demand for extra iron during pregnancy especially in the second half of pregnancy.[36] Therefore, the physiological anemia is due to the combined effect of hemodilution and negative iron balance. Although menstruation-related iron losses are reduced to nil during pregnancy,

additional iron is nevertheless required for the fetus, the placenta, and the increased maternal blood volume. This amounts to approximately 1000 mg of iron over the entire pregnancy.[37] Requirements during the first trimester are relatively small, 0.8 mg per day, but rise considerably during the second and third trimesters to a level of 6–7 mg per day.[38]

Low socioeconomic factors (such as low educational level, unemployment, and poor living accommodation) were also reported as risk factors for the development of iron deficiency anemia in pregnancy.[12] Anemia serves as an indicator of a socioeconomic disadvantage because it is inversely related to the socioeconomic status of households especially in developing settings.[39] Individuals with low socioeconomic status are at a higher risk of exposure to anemia and its sequelae.[40] The majority of the women with iron deficiency anemia have no occupation as they were housewives with little or no official income.[12] This may bring about poor nutritional status among pregnant women as they have low purchasing power and hence low access to better nutrition and better health conditions. In addition, pregnant women are expected to pay for the iron tablets and other medications. Evidence from the review also suggests that women who lack money limit their choice and uptake of iron.[12] Opportunities should be created for women's empowerment.

Closely related to no occupation is low educational attainment which was also reported as a risk factor for iron deficiency anemia. It was reported that the majority of the women with iron deficiency anemia had no formal education or primary education which impacts their economic status.[12] It is a common belief that more enlightened women would secure a better job, have a better living condition, and keep better hygienic practices; hence, lower incidence of iron deficiency anemia possibly due to better nutrition as well as reduced chances of parasitic infections, already found to be common in this population.[41]

Despite the efforts to reduce iron deficiency anemia in pregnancy by administering iron tablets to be taken routinely in pregnancy, this review has also shown that uptake of routine iron by pregnant women is suboptimal. Factors reported affecting routine iron therapy in pregnancy include non-utilization of antenatal care services, low educational attainment, closeness to a health facility, single and teenage mothers.[42,43]

The use of antenatal care services was reported to be associated with compliance with routine iron therapy. Women who use antenatal care services complied more than those who did not use antenatal care services.[43] This is not surprising considering the fact that using antenatal care services exposes women to a lot of benefits. Antenatal clinics offer a lot of services including health education. Health education was demonstrated to be valuable as pregnant women who attend antenatal care were enlightened on the need for routine iron therapy, good nutrition, dispel misconceptions and harmful practices. Moreover, during antenatal care, iron tablets are usually administered to them in addition to other routine drugs and they are usually encouraged to take them to prevent iron deficiency anemia.[44]

Another factor reported to be associated with compliance to routine iron uptake is the distance to a health facility as those who live close to a health facility tend to utilize antenatal services with better compliance to routine iron therapy than those who live far away.[42] Generally, distance has been identified as an important barrier to the use of antenatal care services especially in rural areas.[45,46] Distance from a health facility is linked to other factors such as availability and cost of transport. Therefore, a distance far away from a health facility may imply some transportation costs and difficulty accessing health care.

Educational status was also reported as a factor associated with compliance with routine iron therapy among pregnant women. Pregnant women who had secondary education and above were reported to comply more than those who had no formal education or had primary education.[42] The finding is supported by other studies done on factors that affect routine iron therapy in pregnancy.[47,48] This might be due to the fact that education would increase women's access to information about iron deficiency anemia and ways to overcome it. In addition, it might also be associated with the fact that educated women have a greater ability to stick to health care advice which is beneficial for both the mother and child.

Findings from this review also reported that living in the rural areas are associated with noncompliance to routine iron therapy.[43] Pregnant women who reside in urban areas complied more than those who live in rural areas. This may be because living in urban areas facilitates easier access to a health facility due to easier transportation and, therefore, easy access to iron and other supplements which are usually given as part of antenatal services.

Poor compliance with routine iron therapy was also reported to be more with single and teenage mothers.[43] Previous studies have also shown that compliance with routine iron therapy in pregnancy is poor among adolescents.[49] The reason for low compliance among adolescent girls could be due to lack of knowledge regarding their hemoglobin status and the usefulness of iron in building up their hemoglobin level.

Increasing age above 30 years was also found to be associated with poor compliance with routine iron therapy during pregnancy.[43] Other studies have also reported similar findings.[49,50] This could be due to the fact that most of the youngest women are likely to be first-time mothers, hence, more keen to adhere to the advice given on routine iron therapy to ensure the best maternal and fetal outcome. Women who are older are likely to have been pregnant before, may also have experienced side effects of iron before and were, therefore, hesitant to take iron tablets. They may take for granted advice during pregnancy especially if they have not experienced any difficulties with the previous pregnancy.[50] This shows the need to persistently teach pregnant women the importance of adhering to routine iron therapy in their subsequent pregnancies.

Some of the reasons given by noncompliant pregnant women for not adhering to routine iron uptake were forgetfulness, fear of side effects (gastrointestinal upsets, constipation, and nausea), and fear of harm to the baby.[49] The finding of this study is supported by other studies.[51,52] A possible explanation for forgetfulness maybe because most pregnant women might be tired after the day's activities. The majority of women who do not comply with routine iron therapy have a misunderstanding that consuming iron tablets during pregnancy may cause harm to their baby.[53] Proper counseling will help to correct superstitious belief about taking iron tablets among pregnant women encouraging them to embark on routine iron therapy as prescribed.

Study limitations

The limitations of this study include the fact that only PubMed was used for data extraction. Although PubMed is regarded as one of the most outstanding and globally recognized easily assessable databases for health sciences publications, our inability to search other databases may have resulted in missing additional relevant publications. Another limitation of this study has to do with the scope of the reviewed publications. Every study reviewed was conducted only in a section of Nigeria. Consequently, it may be inappropriate to generalize the findings because of the diverse socioeconomic and cultural settings of Nigeria. There may be a need to repeat some of the studies in other parts of the country to see if there will be similar or contrary outcomes. Some risk factors for an iron deficiency which are common in developing countries, for example, parasitic infestations and chronic diseases were not assessed for. Furthermore, upset gastro intestine which is common during pregnancy and may have contributed to poor compliance to routine iron therapy was not assessed.

Conclusion

The prevalence of iron deficiency anemia in pregnancy is still high in Nigeria. Risk factors associated with iron deficiency anemia include multiparity, third trimester of pregnancy, and poor socioeconomic status (low educational attainment, poor economic status, occupation, poor living condition). Factors associated with poor compliance to routine iron therapy include non-utilization of antenatal care services, low educational attainment, distance to a health facility, single and teenage mother, increasing age, and living in the rural area. There should be continuous awareness creation and health education on the importance of utilization of antenatal care services as well as family planning services, provision of health facilities to areas where they are not available to encourage early booking and utilization of antenatal care services, education, and economic empowerment of women.

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Conflicts of interest

There are no conflicts of interest.

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