A STUDY OF RISK FACTORS FOR ANAEMIA IN PREGNANCY AT THE FIRST ANTENATAL CLINIC VISIT AT NNAMDI AZIKIWE UNIVERSITY TEACHING HOSPITAL, NNEWI.

Chikwendu, MC,[1] Nkemena, B,[2] Udigwe, GO,[2] Obiechina, NJA,[2] Nnaji, GA,[3]

[1]Department of Obstetrics & Gynaecology, Anambra State University Teaching Hospital, Awka, Nigeria.
[2]Department of Obstetrics & Gynaecology, Nnamdi Azikiwe University Teaching Hospital, Nnewi, Nigeria.
[3]Department of Family Medicine, Nnamdi Azikiwe University Teaching Hospital, Nnewi, Nigeria.

ABSTRACT

Background: This study is justified because anaemia in pregnancy is very common in this country and it is a major cause of maternal and perinatal morbidity and mortality among our populace.

Aim: To identify the risk factors for anaemia in pregnancy and evaluate the effects of these risk factors of anaemia in pregnancy among pregnant women attending their first (booking) antenatal clinic visit at NAUTH, Nnewi Anamabra State.

Methodology: This case control study involved seven hundred and fifty pregnant women at their first antenatal visit with three hundred and seventy-five as cases with anaemia compared to a matched three hundred and seventy-five controls without anaemia. The socio demographic, medical and obstetric information data were obtained including laboratory data. The data was analysed using univariate analysis and logistic regression.

Result: Univariate analysis revealed some potential risk factors, but after adjustment using logistic regression only six factors remained associated with increased risk of anaemia in pregnancy. These were low socioeconomic status (OR = 2.3), primigravidity (OR = 3.2), inter-delivery interval of 2 years or less (OR = 35.2), twin pregnancy (OR = 3.2), HIV infection (OR = 1.5), and malaria parasitaemia (OR=2.2).

Conclusion: The application of risk modifying practices and the institution of programmes that would enhance the economic status of women would help reduce the incidence of anaemia and improve nutrition. Improvement in the quality and availability of family planning would increase inter delivery interval while early and appropriate use of antenatal care would provide focus on primigravidae and women with multiple pregnancy and also help in identification of patients HIV sero- status for effective management. Moreover, early institution of intermittent preventive therapy for malaria especially in primigravidae, sustained rollback malaria programme including use of insecticide treated nets would all contribute significantly to the reduction of pregnancy anaemia and indirectly maternal mortality.

Keywords: Anaemia, pregnancy, antenatal care, risk factors.

INTRODUCTION

Anaemia is the most common medical complication of pregnancy worldwide.[1] It is estimated by the World Health Organization (W.H.O) that anaemia affects two-fifth of non-pregnant women and over

Correspondence: Dr. Chikwendu, MC
Department of Obstetrics & Gynaecology, Anambra State University Teaching Hospital, Awka, Anambra State, Nigeria.

half of the pregnant women in developing countries.[2, 3] Anaemia is very common in many developing countries averaging 60% in prevalence during pregnancy.[4] It is more common in non-industrialized countries such as Nigeria than in the industrialized regions of the world.[5, 6, 7] Anaemia is a cause of maternal mortality in Nigeria. Figures from the United Nations Children's Fund (UNICEF) and W.H.O quote maternal mortality as 585,000 per year worldwide.[4,8] Anaemia has also been associated with a higher percentage of maternal deaths in developing countries.[9, 10] Actually a woman dies every minute, from complications arising from pregnancy and delivery.[11] In Nigeria anaemia, remains one of the four major causes of maternal death, and is also associated with high foetal wastage.[4, 12] Moreover, most direct causes of maternal death are neither completely preventable nor predictable.[13] However, with good antenatal care, anaemia could be prevented by adopting a risk assessment approach.

Factors predisposing to anaemia in pregnancy include young age, grandmultiparity, low socio-economic status, illiteracy and inter pregnancy interval of less than one year.[14, 15, 16] Other predisposing factors include malnutrition, under nutrition, infections and infestations. The importance of some of these risk factors varies in different populations. The prevalent risk factors for anaemia in some studies may vary with what is found in others.[1, 17, 18] In view of that, a control group is necessary as it will enhance our assessment of the contributions of various factors associated with anaemia in pregnancy. This hospital based case control study was carried out to identify the prevalent risk factors that predispose pregnant women to anaemia at NAUTH, Nnewi. Moreover, the unacceptably high prevalence of anaemia in pregnancy may be an underestimate; data from the rural areas is lacking.[19] More complete and up-to-date information is necessary. The information obtained would be used to improve policies and programmes that will help to reduce the incidence of anaemia in pregnancy and thereby reduce maternal mortality in our communities and elsewhere.

METHODOLOGY

This case control study was conducted at the various antenatal clinics in Nnamdi Azikiwe University Teaching Hospital, Nnewi. Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nnewi is a referral centre receiving patients from within Anambra state and its environs. The hospital also manages non- referral patients and uncomplicated obstetrics and gynaecology cases. It is one of the teaching hospitals in the south east geopolitical zone. The climate of Nnewi is of equatorial type with temperature that ranges from 25-33^{0}C annually. There are two main seasons the rainy season which starts from March to September and the dry season which starts from October to February.

The study population included pregnant women attending their first (booking) antenatal clinic in NAUTH. The subjects who met the criterion for this study were recruited after an informed consent was gotten from the subjects. The subjects who gave informed consent were recruited to complete the survey instrument which is a confidential questionnaire (see appendix 3). The questionnaires were coded with serial numbers for easy identification.

The study was a case control study of risk factors for anaemia in pregnancy.

Those included in the study were pregnant women attending their first (booking) antenatal visit at NAUTH, Nnewi, women who were ready to participate in the study and sign the consent form, and those women who had not been transfused in the index pregnancy.

Those excluded were pregnant women who were

transfused in the past 4 months before presentation, patients with ante partum haemorrhage, haemoglobinopathy, and patients with AIDS.

Procedure: Formal approval was sought form (NAUTH) ethical committee. Consultation was held with the head of department, consultants, resident doctors and nursing staff of the department and antenatal clinic. All pregnant women attending the antenatal clinic in NAUTH, Nnewi for the first (booking) visit in NAUTH, Nnewi were enrolled into the study by giving them information on the purpose, value and the nature of the procedure and their consent sought. Those pregnant women who give informed consent had the questionnaire administered to them by the researcher or a trained healthcare assistant. The patients were allotted serial numbers in order of their arrival. Information was collected from the questionnaire and from the laboratory. Information was also to be collected in collaboration with the midwives at the antenatal clinic as well as the laboratory staff. Using the usual booking protocol of the unit medical, obstetric and gynaecological histories were obtained. After the history, physical examination including general and systematic examination were performed. Measurement of weight, height and blood pressure were done by midwives. Thereafter, the laboratory investigations such as packed cell volume (PCV) and thick blood film for malaria parasites were performed. The result of other routine investigations were obtained from the laboratory.

The routine investigations at first (booking) visit needed include: packed cell volume, haemoglobin genotype, urinalysis and HIV screening results. The HIV screening was offered to all pregnant women with the option to opt- out by the Heart to Heart (HIV) unit. It was explained to the subjects that the laboratory investigations required for the study were basic investigations carried out at booking for all pregnant women attending antenatal clinic.

Cases and controls: The cases were those pregnant women attending the antenatal clinic for the first (booking) visit during the index pregnancy who had anaemia. The controls were selected on the basis of the women at the same gestational age, seen immediately after the anaemic case, with a packed cell volume of 30% or above. Anaemia in pregnancy was defined as a PCV of less than 30% for the purpose of this study.

Both potential cases and controls were further interviewed, to obtain information on socio demographic characteristics of patients and their husbands as well as the patient's medical, obstetric and gynaecological histories relevant to the study. All such information were recorded on questionnaire for the study.

A disposable plastic syringe was used to withdraw 2 mls of blood from an arm vein from both potential cases and control, the blood specimens were placed in specimen bottles containing ethylene diamine tetra-acetic acid (EDTA) anticoagulant for determination of PCV and malaria parasites. The PCV for both case and control was done by centrifuging blood samples in two capillary tubes using, a microhaematocrit centrifuge (Hawskey, England) and the PCV were read off using a Hawskey microhaematocrit reader. A thick blood film was stained with Giemsa stain and examined for malaria parasites under light microscopy. The same laboratory technician conducted the laboratory tests to exclude inter-observer error.

Ethical clearance for the study was obtained from the ethical committee of the Nnamdi Azikiwe University Teaching Hospital, Nnewi.

Information on the purpose, value and nature of the study were explained to the subjects and their consent obtained. An informed consent was obtained in writing before recruiting each subject into the study. They were assured of confidentiality

in handling of data obtained from them and they were given the option to opt out of the study if they wished. They were assured that their decision to participate in the study was entirely voluntary and that refusal to participate would attract no penalty or loss of benefits to which they would otherwise be entitled.

The study recruited pregnant women attending antenatal clinic for the first time in NAUTH, Nnewi. The sample size of 375 for cases was matched with another 375 for controls. This was recruited in about 6 weeks.

Data analysis of the study population of pregnant women was done using the Epi-Info version 3. 5. 1 software. Frequency tables were computed for all variables using the software with cases separated from controls. Continuous variables such as age and parity were considered as individual data and as combined summary measures. For social class classification, each woman in the study was allotted to one of the five social classes as recommended by Olusanya et al.[20]

Bivariate analysis was used to determine associations between independent variables such as age, parity, socioeconomic status and pregnancy anaemia. The result was analysed further using cross tabulation to explore statistical relationships between variables through chi-square. The chi-square tests with Yates correction and odd ratios were used to assess relationship between anaemia and each variable. The level of statistical significance was set at $p = 0.05$ (at 95% confidence interval).

Using logistic regression the adjusted odd ratios were estimated thus identifying independent risk factors while controlling for confounding variables.

RESULTS

In this study a total of 375 cases of anaemia in pregnancy with 375 appropriate controls were studied. Some of the sociodemographic, medical and obstetric characteristics of the cases and controls were displayed on tables I and II during analysis of the data. For the cases the age ranges between 16 and 45 years, while the mean age was 29.3 years. For the controls the age ranges between 17 and 42 years, while the mean age was 29.0 years. Seventy per cent of the cases were less than 30 years of age compared to 55% of the controls. The mean body mass index for the cases was 26.3 kg/m^2 as against 26.0 kg/m^2 for the controls. Almost all the cases 371 (98.9%) were married while only 4 (1.1%) were single as against 375 (100%) of the controls who were all married. Two (0.5%) of the cases amongst the married were in polygamous marriage setting as against 7 (1.9%) of controls. Three hundred and thirty (88%) of the cases live in urban area while 12% live in rural area as opposed to 92.8% of controls in urban area with only 7.2% in rural area. One hundred and eighty-five (49.3 %) of cases were primigrvidae as against 26.4% of controls. Forty (10.7%) of cases were grandmultiparae compared to 38 (10.0%) of controls. Over 70% of the cases booked in the second trimester as against 60% of controls. One hundred and thirteen (30.1%) of cases were of low educational status as opposed to 18.9% of controls. One hundred and twenty-four (33.0%) of cases were either unskilled in occupation or unemployed as against 109 (29.1%) of controls. Thirty-five (9.3%) of husband of cases were of low educational status compared to 17 (4.5%) of husband of controls. Forty-two (11.2%) of husband of cases were either unskilled in occupation or unemployed compared to 31 (8.3%) of controls.

Table II also showed that more cases than controls were in low income and low socioeconomic group. One hundred and forty-two (37.8%) of cases had a delivery interval of less than two years as against 47 (12.1%) of controls. The table further showed that more cases than controls had malaria parasitaemia, had a higher incidence of twin pregnancy, and also

had Human immunodeficiency virus (HIV) infection. These differences were all significant.

The distribution of haemoglobin values, also in table II, shows that only 4 (1.1%) had severe anaemia, 82 (21.9%) had moderate anaemia while 289 (77.1%) had mild anaemia in pregnancy.

Some of the sociodemographic, medical and obstetric variables were analysed in tables I and II, and these showed that some of the factors were independently associated with increased risk for anaemia in pregnancy. The tables revealed that a significantly increased risk of developing pregnancy anaemia was associated with teenage pregnancy (OR = 20.4), Primigravidity (OR = 1.8), delivery interval of 2 years or less (OR = 6.5), and patients in second trimester (OR = 1.6) when compared with the first or third trimester. Low level of education in either patient or husband was also significantly associated with increased risk of anaemia in pregnancy (OR = 2.4 and OR = 2.1) respectively. Unemployment or unskilled occupation in either patient or husband was also associated with increased risk of anaemia in pregnancy (OR = 7.2 and OR = 3.2) respectively. Table II also revealed that patients with low combined family income and those in low socioeconomic class were at increased risk of developing pregnancy anaemia (OR = 2.1) and (OR = 2.4) respectively. Patients who had twin pregnancy (OR =2.5) and malaria (OR = 1.9) during pregnancy were also at increased risk of anaemia during pregnancy. Women with HIV positive status among the cases (OR = 1.8) were also shown to be at increased risk of anaemia in pregnancy.

The factors that were found to be significant in the bivariate analysis were subjected to logistic regression using the Epi Info version 3.5.1 software adjusting for confounding variables.

After adjustment table III shows that, 6 factors remained significantly associated with an increased risk of anaemia in pregnancy. These factors were twin pregnancy (OR = 3.2,CI = 1.2-23.4), primigravidity (OR = 3.2, CI = 2.1- 5.5), inter-delivery interval of 2 years or less (OR = 35.2,CI = 11.6-107.7), low socio-economic class (OR = 2.3, CI = 1.6- 5.3), HIV infection (OR = 1.5, CI = 1.3-4.5), and malaria parasitaemia (OR = 2.2, CI = 2.5-6.2).

Table I: Some Socio-Demographic Characteristics Of 375 Cases And 375 Controls, Crude Odd Ratios (Or) And 95% Confidence Intervals (Ci).

Risk Factor	Case. n_1=375(%)	Control. n_2=375(%)	OR 95%(CI)	P value
Age				
= 19	27 (7.2%)	2 (0.5%)	20.4(4.6 -126.6)	P =0.0001
20- 29	238(63.5%)	207 (55.3%)		
= 30	110(29.3%)	166(44.2%)		
Marital Status				
Single	4 (1.1%)	0 (0.0%)	4.7,	ns
Married	371 (98.9%)	375 (100 %)	0.3,	ns
Marriage Type*				
Monogamy	369 (98.4%)	368 (98.1%)	3.6,	ns
Polygamy	2 (0.5%)	7 (1.9%)		ns
Patient education				
None/Primary	113(30.1 %)	71 (18.9%)	2.4(1.5-3.8)	P=0.0004
Secondary	195 (52.0%)	202 (53.9 %)	0.6(0.4 -0.8)	P= 0.005
Tertiary	67 (17.9 %)	102 (27.2 %)	0.4(0.3 -.6)	P=0.0004
Patient occupation				
None/Unskilled	124 (33.0 %)	109 (29.1 %)	7.2(4.2 -12.6)	P=0.001
Skilled	229 (61.1 %)	126 (33.6 %)	1.6(1.1 -2.3)	P=0.006
Professional	22 (5.9 %)	140 (37.3 %)	0.1(0.1 -0.2)	P=0.0001
Husband education				
None/Primary	35 (9.3 %)	17 (4.5 %)	2.1(1.2 -3.9)	P=0.02
Secondary	276(73.6%)	280(74.7%)	0.5(0.3 -0.9)	P=0.01
Tertiary	64(17.1%)	78(20.8%)	0.4(0.2 -0.8)	P= 0.006
Husband occupation				
None/Unskilled	42(11.2%)	31(8.3%)	3.2(1.7 -5.8)	P=0.0005
Skilled	282(75.2%)	225(60.0%)	0.9,	ns
Professional	51(13.6%)	119(31.7%)	0.3(0.2 -0.6)	P= 0.0005

Table II

Socio-economic and medical characteristics of cases and controls, crude odds ratios and 95% confidence intervals

Risk Factor	Cases.n $_1$=375(%)	Controls.n $_2$=375(%)	OR 95%CI	P value
Combined family income per month				
< N 10,000	9 (2.4 %)	4 (1.1 %)	2.1(1.7 -10.4)	P =0.04
N 10,000- N 20,000	222 (59.2 %)	201 (53.6 %)	0.5,	ns
>N 20,000	144 (38.4 %)	170 (45.3 %)	0.4,	ns
Residential area				
Rural	45 (12.0 %)	27 (7.2 %)	1.8(1.1-2.9)	P =0.03
Urban	330 (88.0 %)	348 (92.8 %)	0.6(0.3 -1.0)	P= 0.03
Gestational age				
First trimester	51 (13.6 %)	87 (23.2 %)	0.5(0.3 -0.7)	P =0.0001
Second trimester	275 (73.3 %)	223 (59.5 %)	1.6(1.1 -2.5)	P= 0.02
Third trimester	49 (13.1 %)	65 (17.3 %)	1.3,	ns
Parity				
None	185 (49.3 %)	99 (26.4 %)	1.8(1.1-3.1)	P =0.02
1- 4	150 (40.0 %)	238 (63.6 %)	0.6(0.4 -1.0)	P= 0.03
= 5	40 (10.7 %)	38 (10.0 %)	0.6(0.3 -.9),	P=0.02
Delivery interval **				
= 2 years	142 (37.8 %)	47(12.1 %)	6.5(4.2 -9.9)	P = 0.0001
>2 years	92 (34.6 %)	197 (52.5 %)	0.2(0.1 -0.2)	P= 0.001
N/A	141 (37.6 %)	131 (34 .9 %)		
Twins				
Yes	31(8.3%)	13(3.5%)	2.5(1.2 -5.2)	P=0.005
No	344(91.7%	362(96.5%)		

Table II: continued

Risk Factor	Cases.n $_1$=375(%)	Controls.n $_2$=375(%)	OR 95%CI	P value
Malaria parasitaemia				
Yes	40(10.7 %)	22(5.9%)	1.9(1.1 -3.4)	P = 0.02
No	335 (89.3 %)	353 (94.1 %)		

Table II

Socio-economic and medical characteristics of cases and controls, crude odds ratios and 95% confidence intervals

Risk Factor	Cases.n $_1$=375(%)	Controls.n $_2$=375(%)	OR 95%CI	P value
Combined family income per month				
< N 10,000	9 (2.4 %)	4 (1.1 %)	2.1(1.7 -10.4)	P =0.04
N 10,000- N 20,000	222 (59.2 %)	201 (53.6 %)	0.5,	ns
>N 20,000	144 (38.4 %)	170 (45.3 %)	0.4,	ns
Residential area				
Rural	45 (12.0 %)	27 (7.2 %)	1.8(1.1-2.9)	P =0.03
Urban	330 (88.0 %)	348 (92.8 %)	0.6(0.3 -1.0)	P= 0.03
Gestational age				
First trimester	51 (13.6 %)	87 (23.2 %)	0.5(0.3 -0.7)	P =0.0001
Second trimester	275 (73.3 %)	223 (59.5 %)	1.6(1.1 -2.5)	P= 0.02
Third trimester	49 (13.1 %)	65 (17.3 %)	1.3,	ns
Parity				
None	185 (49.3 %)	99 (26.4 %)	1.8(1.1-3.1)	P =0.02
1- 4	150 (40.0 %)	238 (63.6 %)	0.6(0.4 -1.0)	P= 0.03
= 5	40 (10.7 %)	38 (10.0 %)	0.6(0.3 -.9),	P=0.02
Delivery interval **				
= 2 years	142 (37.8 %)	47(12.1 %)	6.5(4.2 -9.9)	P = 0.0001
>2 years	92 (34.6 %)	197 (52.5 %)	0.2(0.1 -0.2)	P= 0.001
N/A	141 (37.6 %)	131 (34 .9 %)		
Twins				
Yes	31(8.3%)	13(3.5%)	2.5(1.2 -5.2)	P=0.005
No	344(91.7%	362(96.5%)		

Table II: continued

Risk Factor	Cases.n $_1$=375(%)	Controls.n $_2$=375(%)	OR 95%CI	P value
Malaria parasitaemia				
Yes	40(10.7 %)	22(5.9%)	1.9(1.1 -3.4)	P = 0.02
No	335 (89.3 %)	353 (94.1 %)		

Risk factors	Regression coefficient and standard error (SE)	Adjusted Odds Ratio (95% CI)
Primigravidity	0.1087(0.0834)	3.2(2.1 -5.5)
Twin pregnancy	0.7041(1.3169)	3.2(1.2 -23.4)
Delivery interval = 2 years	3.5622(0.5669)	35.2(11.6 -107.7)
Low socio-economic class	0.1204(0.6265)	2.3(1.6 -5.3)
HIV infection	0.1550(0.4058)	1. 5(1.3-4.5)
Malaria parasitaemia	0.7945(0.7096)	2.2(2.5 -6.2)

DISCUSSION

The significant role played by low socioeconomic class in increasing the risk of anaemia in pregnancy was confirmed in this research work. As observed by Ogbeide et al[6] we found that majority of the pregnant women in the low social class group were anaemic 20.0% as against 9.9% of controls in this study. Moreover, this association was found to be statistically significant and even after adjustment for potential cofounders, there still existed an increased risk (OR=2.3, CI= 1.6-5.3) of developing pregnancy anaemia when a woman was in the low socioeconomic class. This was not unusual as several investigators had earlier noted this association between low socioeconomic class and pregnancy anaemia.[6,21,22,20]

A review of indices of socioeconomic status revealed that there were associations between the poor socioeconomic state and an increased risk of anaemia in pregnancy. Hence, pregnant women in the low income group (OR = 2.1) were all at increased risk.

Poor socioeconomic status through a variety of mechanism is associated with increased risk of pregnancy anaemia.[1,5] Anaemia in pregnancy is often of multiple aetiology, however, iron and folate deficiency (nutritional anaemia) has been known over the time to be the most important aetiological factors, as shown by Ogunbode in his study.[4] Other investigators[23,24] also noted nutritional anaemia to be a characteristic of the low income population. This was thought to be related to dietary habits, and in such cases, the woman may have started off the

pregnancy with low haematocrit which got worsened by increased pregnancy demands.

The factors which influence the availability, intake, and utilization of these nutrients would have a great toll on the development of anaemia in pregnancy. Poverty, with marginal disposable income and dietary restrictions predispose women to under nutrition and malnutrition.[5, 25] This is related to unsatisfactory ways of preparing food stuff such as over-cooking (which destroys its nutritional value), to food storage problems and poor dietary habit. Women in low socioeconomic class are more likely to consume diets that are low in meat protein, low in vitamins, high in carbohydrates and phytates-contents which reduce iron absorption.

This study found low education level as a risk factor for anaemia in pregnancy (OR=2.4, CI=1.5-3.8). This agrees with findings by other investigators [22] who also found an association between low level of education in young mothers and anaemia in pregnancy. In another study, illiteracy was found to be associated with high parity, and high parity resulted in greater percentage of women with anaemia, hence anaemia in pregnancy was more common among illiterate pregnant mothers.[26] Mothers with a higher level of education are gainfully employed, have better self esteem, are more aware of the need for better nutrition and also avoid harmful cultural practices.[1] Educational status is obviously a strong factor in reducing the predisposition of the pregnant women to anaemia. This can also be through the utilization of available health services and healthy life style adapted by educated females .[27]

The study revealed that women whose husbands were in unskilled occupations or unemployed were more than three times at risk of having anaemia in pregnancy (OR = 3.2, CI = 1.7 - 5.8). Earlier studies had established that the most important determinant of social class in a modern African society, irrespective of nationality, ethnicity or religious affiliation were education, income and occupation,[28] and husband occupation was used in the socioeconomic score determination model in this study. Combined household income determines the family's ability to purchase essential items needed for the upkeep of the family. Hence, wives whose husbands were in the low income group were understandably at risk of anaemia in pregnancy. There is need also to state that other factors characteristic of low class play a moderating role here. This highlights the essence of the United Nation millennium development goal one aimed at eradicating extreme poverty and hunger with target to reduce by half proportion of people living on less than one dollar a day.

Generally the socioeconomic status of these women in developing countries could be improved by teaching various ways by which they could improve on their earning powers during routine antenatal clinic attendance [5] and thereby improving their nutritional status.

The influence of parity on the predisposition to the development of anaemia in pregnancy has been a source of focus to many investigators and the resulting findings has been inconclusive as the studies themselves. While some investigators [29,30] point to the primigravida state as being at increased risk, others[6,31] emphasize that the multipara , for several reasons stand a greater risk of having pregnancy anaemia. Still some others[17, 32] find no clear cut association between parity and anaemia in pregnancy.

In this study, we found, that the primigravida after adjustment for potential cofounders was more likely to develop pregnancy anaemia than a multipara (OR = 3.12, CI = 2.1-5.5). This is in agreement with the observations of Isah et al[33] who noted that anaemia occurred most frequently in the primigravida. In fact they noticed that the

prevalence of anaemia decreased with increasing parity. Similarly, Fleming et al [34] in their study of a homogenous group of young Hausa non-elite primigravida living in Zaria found that over 40% of them were anaemic. The mechanism so far proposed for this is through the effect of red blood cell haemolysis occasioned by malaria.[29] However, it is possible that the primigravida carrying pregnancy for the first time do not fully understand the need for complementary care and improved nutrition.

Interestingly, this study did not find the grand multiparous woman (OR = 0.6, CI = 0.3 – 0.9) to be at an increased risk as observed by Ogbeide et al .[6] The multiparous patients had gained experience from their earlier pregnancies with consequent increased awareness of the value of good diet and care, as suggested by Chukwudebelu et al.[17]

In this study after adjustment for cofounders, women with malaria parasitaemia (OR=2.2) were at increased risk of developing anaemia during pregnancy. This is in agreement with the findings of several investigators.[35-39] In another study by Tukem, Achid and Ndumbe in Cameroon high level of parasitaemia caused more destruction of red blood cells hence reducing haemoglobin levels leading to anaemia and it also showed that 44% of anaemic patients with malaria parasitaemia were caused by malaria .[40] Anaemia in pregnant women frequently results from malaria infection in many areas of stable malaria in sub-Saharan Africa .[41] Actually over 90% of world's malaria occurs in Africa.[42] Primigravidae are more affected by malaria than multigravidae. Malaria is endemic in this region and transmission occurs all year round but more in rainy season.[19] Work in Western Nigeria by Fleming [43]noted that malaria, often complicated by folate deficiency was a common cause of severe anaemia in pregnancy. Mati et al,[29] similarly, in their study in Kenyan population noted that 4.6% of these cases with pregnancy anaemia had malaria parasitaemia. In another study by Sinei et al, [31] they found that about one third of anaemic pregnant women had malaria parasitaemia.

Malaria causes haemolysis of red cells with resultant anaemia. Resistance to malaria is diminished during pregnancy so that there is increased frequency and density of malaria[27] parasitaemia. This is most evident during the second trimester and in first pregnancies .[44] Malaria parasite infection rate have been found to be greater in pregnant women than in non-pregnant. [45] In this study, 10.7% of cases had malaria as against 5.9% of controls. This supports the work of Bray and Anderson[44] who have shown that in the Gambia, the prevalence and density of malaria parasitaemia decreased with increasing parity. In early pregnancy, it has also been argued that the ability to mount an immunological resistance to malaria is decreased. This could be due to depression in cell-mediated immunity.[46]

From our studies, protection against malaria would contribute significantly to the prevention of anaemia in pregnancy . Some other workers [10,25] also made this suggestion. This highlights the essence of chemoprophylaxis and other cheap methods of malaria control such as use of insecticide treated nets and insecticide spray.

This study revealed that women whose last delivery were two years or less after adjustment for cofounders were at increased risk of developing pregnancy anaemia (OR = 35. 2, CI = 11.6 - 107. 7). The result of this study is not surprising since it has been shown that the exhausted maternal iron stores at the end of one pregnancy[47, 32] takes almost two years to be replenished.[21, 48]Utilization of family planning methods have been known to play significant roles in correcting the problem of short birth intervals. Such exposure to family planning methods can best be achieved during routine antenatal and post natal clinic sessions.

The study revealed that most of the cases of anaemia booked in the second trimester 275 (73.3 %) with well over a quarter (33.1 %) in the later part of the second trimester. This is corroborated by other studies[14,49,50,51,52] and this could well be as a result of exaggeration of the normal physiological decline in blood haemoglobin concentration in the second trimester of pregnancy.[50,532] In addition, other possible explanation on the above assertion are increasing fetal demand with advancing pregnancy, worsening of untreated early pregnancy anaemia, underlying maternal diseases and lack of early malarial prophylaxis in women who booked late.[19] Moreover, it has been suggested that in the primigravidae anaemia manifests in the second trimester following haemolysis at the peak malaria prevalence (13-16 weeks).[53] Primigravidae are therefore encouraged to book early and thus benefit from malaria chemoprophylaxis.

Women with Human immunodeficiency virus (HIV) infection in pregnancy in this study after adjustment were shown to be at increased risk of anaemia in pregnancy (OR=1.5, CI = 1.3-4.5). In another study, anaemia was a common manifestation of HIV infection, occurring in approximately 30% of patient with asymptomatic HIV and in as much as 75-80% of those with AIDS .[54,55] This virus is now an established differential diagnosis for anaemia in pregnancy.[25] Moreover, evidence from a primary health care study at Ibadan showed that HIV seropostivity increased the risk of anaemia in pregnancy .[56] Infact, where anaemia is associated with leucopenia or thrombocytopenia, the antenatal staff should be alerted to the possibility of AIDS especially in pregnant women not responding to therapy.[25] Booked women, especially those with risk factors for HIV, should be encouraged to book early at the antenatal clinic for HIV counseling and testing for identification of HIV positive cases and subsequent prevention of mother to child transmission (PMTCT) care.

Thirty-one (8.3%) of cases had twin pregnancy as against (3.5%) of controls, and twin pregnancy after adjustment is associated with increased risk of anaemia in pregnancy (OR 3.2, CI = 1.2-23.4). The incidence of anaemia has been observed by several authors to be increased in multiple pregnancies than in singletons.[57,47] The red cell mass increases approximately 300mls more in multiple than in singleton pregnancies but because this is disproportionately less than the one third increase in plasma volume haemoglobin value falls.[58] Twin pregnancy is associated with increased demand of iron and folic acid by the developing fetuses thus it is not surprising that there is an increased predisposition to anaemia. Moreover, iron stores are diminished in 40% of women with twins, so that routine haematinics supplementation is recommended particularly given the increased risk of hyperemesis during pregnancy and of postpartum haemorrhage at delivery.[58] Therefore, women with an increased risk of having multiple pregnancy, such as positive family history, should be encouraged to book early at the antenatal clinic for appropriate care to be given.

The validity of the study determines in part whether the results can be applied for policy recommendations. Although case control studies may be subject to a variety of biases however no evidence of significant bias was found in this study as far as the data collected were concerned. The self-selectivity of the study population in an institutional based study is a source of concern. In Nnewi, a substantial number of pregnant women come to hospital to book for and receive antenatal care, thus the study population adequately represents the pregnant women in the area.

The criteria for selecting cases and controls and the exclusion criteria were simple, stringent, clear cut and tightly observed. This was necessary to

minimize bias in choosing cases and controls. During the study period, all the patients that met these criteria were included in the study. Therefore, the result of this study can be utilized for policy recommendations.

In conclusion, the significant risk factors for pregnancy anaemia, after adjustment for potential cofounders, found in this study were low socioeconomic status, short birth interval of two years and below, primigravidity, malaria parasitaemia, twin pregnancy and Human immunodeficiency virus infection.

We recommend that general and specific policies and strategies should be instilled such that women would be encouraged to engage in economic activities that can improve their socioeconomic and thus their nutritional status. This would reduce the scourge of malnutrition and under-nutrition and hence reduce pregnancy anaemia

There is also need to educate mothers on the fact that pregnancy is best for adults only hence, reducing teenage pregnancy. The roll back malaria programme which aims to eradicated malaria in Nigeria is a boost in reducing incidence of malaria and hence anaemia in pregnancy. Use of insecticides treated nets, insecticides sprays and intermittent preventive therapy are also measures that help reduce malaria and anaemia in pregnancy. Appropriate family planning programmes need to be intensified especially during antenatal and postnatal clinic sessions. This would help to make family planning readily available and affordable thereby reducing the number of births and also space the pregnancies as desired by the couple. Recommended also is continuation of the HIV counseling and testing at the antenatal clinic which provides a framework for management of females who are HIV positive. Use of mass media and patient information leaflets to encourage early booking and regular attendances to the ANC may also reduce problem of late booking and multiple pregnancy, and hence reduce incidence of anaemia in pregnancy. Regular, availability of skilled medical staff and appropriate health infrastructural facilities would further fortify the existing ones, in management of ANC clients. There is also need for non-governmental organization participation in ANC programmes. Finally, there is need to improve political will at national, state, and local government levels for implementation of some of these programmes.

Limitations: This was a hospital based study and hence it was not truly reflective of the situation in the community due to referral bias. Moreover, the hospital patients were self-selected.

REFERENCES

1. Harrison, K A. Anemia in pregnancy. In Lawson J. B, Harrison K.A, Bergstrom S (editors) Maternity care in developing countries, RCOG press 2001: 112-128.
2. World Health Organization. Prevention and management of severe anaemia in pregnancy report of a technical working group. Geneva WHO 1994, WHI/FHE/MSM/93, 3.
3. Omigbodun A.O Recent trends in the management of anaemia in pregnancy. Trop. J Obstet Gynaecol. 2004; 21 (1): 1-3.
4. Ogunbode O, Anaemia in pregnancy. Trop J Obs. Gyn. 1995; vol 12 suppl. 1 p. 19-25
5. Abudu O.O, Anaemia in pregnancy. In Textbook of Obstetrics and Gynaecology for medical students. Vol 1 in Agboola Ed. USE publishers limited 1988.
6. Ogbeide O, Wagbatsoma V, Orhue, A, Anaemia in pregnancy. East Afr. Med. J 1994; 71 (10); 671-3.
7. Fleming AF, Anaemia in pregnancy in

tropical Africa. Trans. Roy soc. Trop Med. and Hyg. 1989; 83: 441-448.

8. Wilson J.B, Llassey A.T, Maternal Mortality in the tropics. In Kwawukume E.Y. Emuveyan E.E (editors). Comprehensive Obstetrics in the tropics. 1st edition Asante and Hiltscher printing press limited, Dansoman, 2002; p. 243-249.
9. Viteri F E, The consequence of Iron deficiency and anaemia in pregnancy Adv. Exp. Med Bio 1994; 352: 127-139.
10. Bhatt. R, Maternal Mortality in India. FOGSI- WHO study. J Obstet Gynaecol. 1997; 47: 207-214.
11. Inter-Agency Group for Safe Motherhood. Safe Motherhood: helping to make women's reproductive health and rights a reality. New York, Family care International vol 2, 1988.
12. Hinderaker S.G, Olson B.E, Lie R.T et al, Anaemia in rural Tanzania: association with micro-nutrients status and infections. E or J Clin. Nutr. 2002; 56:192-199.
13. Fathala, M.F, Imagine a world where motherhood is safe for all women. You can help make it happen. Int. J Gynaecol Obst. 2001 March; 72. No 3, 207-213.
14. Adinma J.I.B, Ikechukwu J.I, Onyejimbe et al, Influence of antenatal care on haematocrit value of pregnant Igbo women. Trop J Obstet Gynaecol.2002; 19(2); 68 – 70.
15. Chotonopparatpottara P, Limpongsanurak S, Chamngam P, The prevalence and risk factors of anaemia in pregnant women. J Med Assoc Thai 2003; 86 (11) 1001- 7.
16. World Health Organization, Prevention in pregnancy. Report of a technical working group, Geneva WHO 1994/FHE/MSM/93.5.
17. Chukwudebelu W.O, Obi G.O, Anaemia in pregnancy in Nigeria, Nig. Med J 1979; 9 (2) 221-223.
18. Dicko et al. Risk factors for malaria infection and anaemia for pregnant women in the Sahel area Bandiagara, Mali. Acta Tropical 2003; vol 89 (1) pp. 17-23.
19. Oboro V.O, Tabowei T.O, Jemikalajah J prevalence and risk factors for anaemia in south-southern Nigeria. J Obstet Gynaecol 2002; 22(6):601-613
20. Olusanya O, Okpere E, Ezimokhai M. The importance of social class in voluntary infertility control in a developing country. West Afr. J O Med, 1985; 4(4): 205 – 211.
21. World Health Organization, The prevalence of anaemia in women: a tabulation of available information. Geneva WHO/MCH/MSM/1992, 92.2
22. Adetoro O O, Agah A. The implications of child bearing in post pubertal girls in Sokoto, Nigeria. Int. J Gynaecol Obstet, 1988,27:73-77.
23. Cardoso M.A, Ferreira M.U, Anaemia, iron deficiency and malaria in a rural community in Brazilian Amazon, Eur J Clin, Nutr., 1984; 48 (5) : 326 – 32.
24. Baker S J, De Maeyer E M, Nutritional anaemia : its understanding and control with special reference to the work of the World Health Organisation. Am J Clin Nutri, 1979; 14 (3): 601-612.
25. World Health Organization. The treatment and prevention of severe anaemia in pregnancy. WHO; 1993/FHE/MSM/193.5
26. Al-farsi Y.M, Brooks DR, Werler M.M. et al. Effect of high parity on occurrence of anaemia in pregnancy: a cohort study. BMC pregnancy and childbirth 2011, 11:7.
27. Desalegan, S, Prevalence of anaemia in pregnancy in Jime town, south western Ethiopia. Ethiop. Med. J. 1993 Oct. 31 (4) : 251-8.

28. Grillo R.D, In : African Railway men, Cambridge University Presss. 1973.
29. Mati JKG, Hatimay, A, Gebbie DAM,The importance of anaemia of pregnancy in Nairobi, and the role of malaria in the aetiology of megaloblastic anaemia. J Trop. Med. Hyg 1971; 64: (2) 1, 8.
30. Deijomaoh et al, The problem of the Grandmultipara as seen at the Benin Teaching Hospital, Benin City, Nigeria, Tropical J. Obst. Gyn, 1788; 5 (1): 13-17 (special edition).
31. Sinei SKA, Mat JOG et al, Prevalence of anaemia of pregnancy and role of malaria in its aetiology in rural Kenya. J. Obst Gyn Cen Afr. 3: 119-122.
32. Knottenbelt J .D,An investigation into the incidence and nature of Anaemia in pregnant West African Women. The Centr. Africa J. Med. 1973; 19: 133-136.
33. Isah HS, Fleming AF et al, Anaemia and iron status of pregnant and non-pregnant women in guinea savanna of Nigeria. Annals of Tropical Medicine and Parasitology.1985; 76(5): 485-493.
34. Fleming A.F, Harrison K A et al, Anaemia in young primigravida in the guinea savanna of Nigeria: Sickle cell trait gives partial protection against malaria. Annals of Tropical medicine and Hygiene. 1984; 78 (4): 395-404.
35. Muhangi L, Woodbum P, Omara M et al. Association between mild—to-moderate anaemia in pregnancy and helminth malaria and HIV infection Entebe, Uganda. Trans R soc Trop. Med. Hyg. 2007:101:899 – 907.
36. Kagu MB, Kawuwa MB, Gadzama GB, Anaemia in pregnancy: a cross-sectional study of pregnant women in Sahelian territory hospital in Northeastern Nigeria. J Obstet Gynaecol. 2007; 27:676 – 679.
37. Tarimo SD, Appraisal on the prevalence of malaria and anaemia in pregnancy and factors influencing uptake of intermittent preventive therapy with sulphadoxin pyrimethamine in Kibaha district Tanzania. East Afr. J Public Health, 2007; 4: 80-83.
38. Ouma P, van- Ejile AF, Hamel MJ et al . Malaria and anaemia among pregnant women at first antenatal clinic visit in Kisumu Western Kenya. Trop Med Int. Health. 2007; 12:1515 – 1523.
39. Mayor A, Aponte JJ, Fogg C, et al, The epidemiology of malaria in adults in rural area of southern Mozambique. Malar. J. 2007; 6:3.
40. Tukem E.T, Achid E.A, Ndumbe PM, An update of malaria infection and anaemia in adults in Buea, Cameroon. BMC Res Notes, 2010; 3; 121.
41. Giuyat HL, Snow RW, The epidemiology and burden of plasmodium falciparum related anaemia among pregnant women in sub-Saharan Africa. Am. J Trop Med. Hyg. 2001, 64 (1, 2) 5.pp. 36 – 44.
42. Okpere E; Okonkwo C, Malaria in Pregnancy In: Okpere E (Ed) Clinical Obstetrics 1st Edition, Uniben Press, 2003:p. 67-74.
43. Fleming A. F, Haematological diseases in the tropics. In: Cook G. C, ed Manson"s Tropical Diseases, 20th ed, London, Saunders. 1996; pp. 101-173
44. Bray R, Anderson MJ, Falciparum malaria and pregnancy. Trans Roy. Soc. Trop. Med. Hygn, 1979, 73, 427-431.
45. World Health Organization, Prevention and management of severe anaemia in pregnancy. Report of a technical working group. Geneva WHO .1994

FHE/MSM/93.5.

46. Chamarin I, Rothman D et al, Folate studies and requirements in pregnancy. BMJ. 1968,2: 290-394.
47. Letsky E, Blood volume, haematinics, anaemia. In: de Sweit (ed) Medical Diagnosis of Obstetric practice 3rd ed. Oxford: Blackwell. 1995; 33-60.
48. Magee H. C, Miligan E. H. M., Haemoglobin level before and after Labour. Br Med. J., 1951, 2, 1307-1310.
49. Idowu O.A, Mafiana C.F, Sotiloye D. Anaemia in pregnancy: a survey of pregnant women in Abeokuta, Nigeria. African Health Sciences, 2005 ,5(4):295-299.
50. Uche – Nwachi E.O, Odekunle A, Jacinto S et al, Anaemia in pregnancy: association with parity, abortions and child spacing in primary healthcare clinic attendees in Trinida and Tobago. Afr. Health Sci. 2010 March; 10 (1):66 – 70 .
51. Hinderaker S.G, Olsen B.E, Bergs J.O, et al, Anaemia in pregnancy in the highlands of Tanzania. Acta Obstet Gynaecol Scand. 2001; 18 – 26.
52. Omietimi J.E, Allagoa D.O, Fiebai P.O, et al. The prevalence of anaemia in pregnancy at the University of Port Harcourt Teaching Hospital (UPTH). Trop. J Obstet Gynaecol, 2003; 20 (1) : 12.
53. Barbin B.J, Hakimim M, Pelletier O, An analysis of anaemia and pregnancy related maternal mortality, J nutri. 2001;131 (suppl): 6045-6155.
54. Petitt J, Moss P, Hofforand V, Essential Haematology 4th ed. Oxford: Blackwell science 2004.
55. Zon L, I, Arkin C, Groopman JE, Haematological manifestation of the Human Immunodeficiency virus. Semin Hematol; 25:208 – 19.
56. Dairo MD, Lawoyin TO, Demographic factors determining compliance to iron supplementation in pregnancy in Oyo State Nigeria, Nig J Med. 2006 Jul –Sep, 15 (3); 241 – 4.
57. Melissa CB, Martin L, Pernoll MD. In Current Diagnosis and treatment in obstetrics and Gynaecology, Alan H.D, Godwin TM, Nathan L, Laufer N (editors) 10th edition Mc Graw – Hill Companies inc. New York.2007; p.302.
58. Fisk, NM, Multiple pregnancy In: Edmonds DK (editor), Dewhurst's Textbook of Obstetrics and Gynaecology 7th edition. Blackwell publishing, Oxford, 2007; 13:10 – 18.