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Studies on the Predisposing Factors of Iron Deficiency Anaemia among Pregnant Women in a Nigerian Community

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Abstract: Iron Deficiency Anaemia (IDA) is a major public health problem in developing countries especially among pregnant women. This study was done on some of the factors that predispose pregnant women to IDA and so identify groups at greater risk. A total of 1387 pregnant women (910 in the urban area and 477 in the rural areas) were recruited for the study. IDA was assessed by measuring haemoglobin (Hb) concentration and the pregnant women were considered anaemic for Hb less than 11g/dl according to World Health Organization Standards. Semi structured questionnaires were used to elicit information on possible predisposing factors such as age, level of education, parity, child-spacing etc. Results obtained showed that mean Hb of the rural subjects, 9.84±1.41g/dl was significantly ($p<0.0001$) lower than that of the urban subjects, 10.44±1.49g/dl. Analysis of the effect of age showed that the younger age category (24 years and below) had significantly ($p<0.0461$) lower mean Hb and significantly ($p<0.0332$) higher percentage of anaemia while the effect of level of education showed significantly ($p<0.0136$) lower mean Hb and higher proportion of anaemia among the less educated (no formal and primary education). The pregnant women with child spacing of less than 1 year and 1-1.5 years had significantly ($p<0.0223$) lower mean Hb and significantly ($p<0.0336$) higher prevalence of anaemia while parity did not show any significant effect on both mean Hb and prevalence of Hb. The implications of these findings are discussed and recommendations made on how to tackle the problem.

Key words: Iron Deficiency Anaemia, pregnant Women, predisposing factors, owerri, Nigeria

Introduction

Iron Deficiency Anaemia (IDA) during pregnancy is widely recognized as one of the major health and nutritional problems among pregnant women in sub-saharan Africa (Royston and Armstrong, 1989). Consequences of IDA include fatigue and reduced work capacity, impaired resistance to infection and greater risk of death associated with pregnancy and childbirth (Stoltzfus *et al.*, 2003) and low birth weight and preterm deliveries (Scholl *et al.*, 1992).

In an effort to prevent and/or control IDA, many developing countries have embarked on routine iron supplementation commencing from the second trimester of pregnancy (Nair *et al.*, 2004). In Nigeria, in spite of more than three decades of the supplementation programme, IDA among pregnant women is still as high as 68.78% (unpublished finding). Although there is still some controversy concerning the optimal stage of pregnancy at which to begin supplementation, several studies have now shown that iron stores at conception are a strong predictor of maternal iron status and risk of anaemia in later pregnancy (Bothwell, 2000; Casanueva *et al.*, 2003). Maternal Iron Deficiency early in pregnancy has been hypothesized to predict the risk of preterm delivery (Allen, 2001). Also it is very difficult to replenish depleted iron stores once pregnancy is in progress (Allen, 2005). It would therefore seem that the best approach to preventing IDA in pregnancy is to ensure adequate maternal iron status early in pregnancy or preferably in the periconceptional period. Hence the need to identify groups at greater risk of developing IDA during pregnancy which can be targeted early enough in any planned appropriate intervention programme. The present study is aimed at determining the effect of age, level of education, parity and child spacing on the incidence of Iron Deficiency Anaemia among pregnant women.

Materials and Methods

Subjects: A total of 1,387 pregnant women took part in the study, 910 in Owerri urban area and 477 in the rural areas surrounding Owerri. The study was carried out at the antenatal clinic of government hospitals and private clinics in Owerri urban area and antenatal clinics of health centers in rural areas surrounding Owerri and covered a period of 11 months.

Approval to carry out the study was obtained from the appropriate health authorities and informed consent obtained from the subjects before the commencement of the study. Pregnant women who had complications such as pregnancy-induced hypertension, infections, malaria, metabolic disorders etc (as indicated in their medical records) were excluded from the study. All the pregnant women in the study received routine prescriptions of iron, multivitamins, folic acid and daraprim (as antimalarial prophylaxis). Data on age, educational level, parity, child spacing, etc were obtained from the pregnant women through a semi-structured questionnaire.

Sampling Technique and Sample Size: For the Owerri urban area, proportionate cluster sampling method was used. Five clusters were identified and one was randomly selected. All the hospitals and clinics in the selected cluster were included in the study. For the rural areas surrounding Owerri, a total of 12 health centers were randomly selected from the 55 health centers belonging to 55 autonomous communities.

Sample size n, for random sampling was calculated using the relationship:

$$n = (Z_{1-\alpha}/\delta)^2 P (1 - P) \text{ (WHO, 1986)}$$

Prevalence, P was taken to be 0.50, which gives the largest sample size.

Sampling error was 5%.

Confidence Coefficient, $1-\alpha = 95\%$; $(Z_{1-\alpha} = 1.96)$.

Accordingly a minimum sample size of 384 was calculated for the rural areas. To take into account the cluster design effect, the calculated random sampling size, n was multiplied by 2 (Lwanga and Lemeshow, 1991). Hence a minimum sample size of 768 was obtained for the Owerri urban area.

Haemoglobin measurement: Haemoglobin was measured with a portable photometer (Hemocue), which uses disposable sample microcuvettes with a dry reagent (sodium azide) into which one drop of capillary blood from a finger prick is drawn and then it is placed into the instrument for automatic haemoglobin (cyanmethaemoglobin) measurement. Results are given in 1-2 minutes. This method is highly comparable to laboratory haemoglobin methods in terms of precision (Van Schenck *et al.*, 1986). In pregnant women, anaemia is mild for Hb 10-11g/dl, moderate for Hb 8-10g/dl and severe for Hb<8.0g/dl (WHO/UNICEF/UN, 1996).

Statistical analysis: Data was analyzed using the software package SAS version 8 (SAS Institute Inc. Cary, North Carolina). Pearson chi square, z test, ANOVA and post Hoc Duncan's multiple range test were used to identify statistically significant differences. Correlation between variables was determined using Pearson's correlation coefficient. Data was considered significant for p<0.05 at 95% confidence limit.

Results

A total of 1,387 pregnant women were included in the study (910 in the urban area and 477 in the rural areas). The rural pregnant women with mean age 25.12±2.96 years were significantly (p<0.0093) younger than the urban pregnant women with a mean age of 27.00±2.18 years. The mean Hb of the rural subjects, 9.84±1.41 g/dl was significantly (p<0.0001 lower than that of the urban subjects, 10.44±1.49g/dl.

Table 1 shows mean Hb and prevalence of anaemia among the pregnant women according to age. overall, the pregnant women below 20 years and 20-24 years age groups had significantly (p<0.0461) lower mean Hb and significantly (p<0.0332) higher percentage of anaemia than the older groups. In the urban subsample, although the mean Hb of the various age groups did not show statistical differences (p<0.3239), the 24 years and below age group had higher proportion of anaemia although not statistically significant (p<0.2447). In the rural sub-sample, compared to the older age groups, the pregnant women 24 years and below had significantly (p<0.0461) lower mean Hb and higher prevalence of anaemia which was not statistically significant, p<0.9496.

Table 2 shows mean Hb and prevalence of anaemia according to educational level. Overall, the no formal education and primary education groups had significantly (p<0.0136) lower mean Hb and higher proportion of anaemia (although not statistically significant, p<0.5961) than the secondary and post secondary groups. In the urban area, the pregnant women with no formal education had significantly (p<0.0011) lower mean Hb than the other groups while the prevalence of anaemia did not show statistical difference among the various groups, p<0.8592. In the rural area, no statistical difference in mean Hb (p<0.2410) and prevalence of anaemia (p<0.2758) was found according to educational level. However, the no formal and primary education groups recorded higher proportions of anaemia.

Table 3 shows mean Hb and prevalence of anaemia according to parity. Overall, there were no significant differences in mean Hb p<0.3509 and prevalence of anaemia p<0.4149 among the pregnant women according to parity. The same trend was observed in both the urban and rural areas. In the urban area, no statistical difference in mean Hb (p<0.1354) and prevalence of anaemia (p<0.0802) was observed. In the rural area also there was no significant difference in mean Hb (p<0.8513) and prevalence of anaemia (p<0.8279).

Table 4 shows mean Hb and prevalence of anaemia according to child spacing. Overall, the pregnant women with child spacing of less than 1 year and 1-1.5 years

Table 1: Mean Hb and Prevalence of Anaemia According to Age of the Pregnant Women

		Hb (g/dl)			
Age (yrs)	Frequency	Range	Mean	s.d	% Anaemic*
Overall					
<20	68	5.90-13.30	9.90[b]	1.67	75.00
20-24	443	5.80-14.20	9.84[b]	1.41	76.07
25-29	454	7.10-14.20	10.25[a]	1.44	65.86
30-34	261	6.30-13.70	10.13[a]	1.46	65.90
35-39	130	8.30-13.60	10.73[a]	1.33	58.46
≥ 40	31	7.10-13.60	9.88[b]	1.10	61.29
Total	1387				
Urban					
<20	35	7.10-13.30	10.64[a]	1.77	62.86
20-24	245	6.40-14.20	10.18[a]	1.37	65.31
25-29	328	7.10-14.20	10.42[a]	1.37	60.37
30-34	186	6.30-13.70	10.20[a]	1.72	59.68
35-39	88	8.30-13.60	10.77[a]	1.43	52.27
≥ 40	28	7.10-13.60	10.02[a]	1.77	57.14
Total	910				
Rural					
<20	33	5.90-12.40	9.41[b]	1.59	87.88
20-24	198	5.80-12.60	9.59[b]	1.43	89.39
25-29	126	7.80-12.20	9.73[ab]	1.57	80.16
30-34	75	8.10-13.10	9.92[a]	1.25	81.33
35-39	42	8.30-13.30	10.63[a]	1.20	73.81
≥ 40	3	8.80-9.00	8.30[c]	0.14	100.00
Total	477				

Values with different superscripts per column are statistically significant p<0.05 (ANOVA used), *% Anaemic: Overall P<0.0322, urban p<0.2447, rural p<0.9496 (Pearson X^2 used)

Table 2: Mean Hb and Prevalence of Anaemia According to Educational Level of the Pregnant Women

		Hb (g/dl)			
Level of Education	Frequency	Range	Mean	s.d	% Anaemic*
Overall					
No Formal Edu	230	7.40-13.60	9.89[b]	1.58	72.61
Primary Edu	236	5.80-13.40	9.93[b]	1.30	83.05
Secondary Edu	621	6.30-13.70	10.19[a]	1.47	65.22
Post Secondary Edu	300	7.00-14.20	10.49[a]	1.45	62.00
Total	1387				
Urban					
No Formal Edu	188	7.40-13.60	9.87[b]	1.60	66.67
Primary Edu	62	7.90-13.40	10.81[a]	1.29	61.29
Secondary Edu	420	6.30-13.70	10.27[a]	1.47	59.52
Post Secondary Edu	240	7.00-14.20	10.71[a]	1.54	57.92
Total	910				
Rural					
No Formal Edu	42	8.80-10.30	9.91[a]	0.42	100.00
Primary Edu	174	5.80-13.30	9.55[a]	1.31	90.80
Secondary Edu	201	8.30-12.60	9.99[a]	1.48	77.11
Post Secondary Edu	60	7.60-12.40	9.43[a]	1.32	78.33
Total	477				

Values with different superscripts per column are statistically significant, p<0.05 (Anova used), *% Anaemic: Overall p<0.5961, urban p<0.8592, rural p<0.2758 (Pearson X^2 used)

had significantly (p<0.0223) lower mean Hb and significantly (p<0.0336) higher prevalence of anaemia than the other groups. In the urban sub sample, although the group with below 1 year child spacing had significantly p<0.0450 lower mean Hb, the prevalence of anaemia did not show any statistical difference (p<0.0941) among the groups. In the rural sub-sample, no statistical difference in mean Hb (p<0.1286) and prevalence of anaemia (0.0528) was observed.

Discussion

The effect of age on the prevalence of anaemia showed that the prevalence of anaemia was higher among

Table 3: Mean Hb and Prevalence of Anaemia According to Parity of the Pregnant Women

Parity	Frequency	Hb (g/dl) Range	Mean	s.d	% Anaemic*
Overall					
Primipara	106	7.20-12.60	10.23[a]	1.10	69.81
1	251	6.40-13.60	10.03[a]	1.52	70.52
2	304	7.40-14.20	10.31[a]	1.38	67.76
3	354	5.80-14.20	10.21[a]	1.51	63.56
4	205	7.00-13.00	10.23[a]	1.64	67.32
>4	167	8.00-12.80	9.80[a]	1.36	80.24
Total	1387				
Urban					
Primipara	100	7.20-12.60	10.26[a]	1.20	68.00
1	185	6.40-13.60	10.12[a]	1.48	68.11
2	220	7.40-14.20	10.55[a]	1.42	63.64
3	240	6.30-13.20	10.46[a]	1.52	52.50
4	112	7.00-13.00	10.42[a]	1.82	53.57
>4	53	8.00-12.50	9.65[a]	1.49	60.38
Total	910				
Rural					
Primipara	6	9.20-10.20	9.70[a]	0.75	100.00
1	66	7.50-13.30	9.75[a]	1.67	77.27
2	84	8.30-13.30	9.58[a]	1.35	78.57
3	114	5.80-12.60	9.57[a]	1.51	86.84
4	93	7.60-12.40	9.96[a]	1.43	83.87
>4	114	8.10-12.80	9.88[a]	1.24	89.47
Total	477				

Values with different superscripts per column are statistically significant, $p<0.05$ (Anova used), *% Anaemic: Overall $p<0.4149$, urban $p<0.0802$, rural $p<0.8279$ (Pearson X^2 used)

Table 4: Mean Hb and Prevalence of Anaemia According to Child Spacing of the pregnant Women

Child spacing	Frequency	Hb (g/dl) Range	Mean	s.d	%* Anaemic
Overall					
Primipara	106	7.20-12.60	10.23[ab]	1.10	69.81
<1 yr	80	5.80-12.30	9.68[b]	1.51	80.00
1-1.5yrs	354	7.40-13.30	9.97[b]	1.30	65.71
1.5-2yrs	415	6.30-12.00	10.20[ab]	1.56	62.41
2-2.5yrs	197	7.00-13.40	10.43[a]	1.60	65.99
Above 2yrs	235	7.90-13.80	10.50[a]	1.45	67.66
Total	1387				
Urban					
Primipara	100	7.20-12.60	10.26[a]	1.20	68.00
<1 yr	50	8.30-12.00	9.99[b]	1.53	72.00
1-1.5yrs	250	7.40-13.00	10.07[ab]	1.28	68.80
1.5-2yrs	295	6.30-13.00	10.47[a]	1.57	54.24
2-2.5yrs	102	7.00-13.40	10.51[a]	1.55	54.90
Above 2yrs	113	7.90-13.80	10.80[a]	1.77	53.10
Total	910				
Rural					
Primipara	6	9.20-10.20	9.70[a]	0.75	100.00
<1 yr	30	5.80-10.00	8.48[a]	1.62	93.33
1-1.5yrs	104	8.30-13.30	9.55[a]	1.32	92.31
1.5-2yrs	120	8.30-12.60	9.98[a]	1.54	82.50
2-2.5yrs	95	9.00-12.40	10.30[a]	1.64	77.89
Above 2yrs	122	8.10-12.50	9.80[a]	1.24	81.15
Total	477				

Values with different superscripts per column are statistically significant, $p<0.05$ (Anova used), *% Anaemic: Overall $p<0.0316$, urban $p< 0.0941$, rural $p<0.0528$(Pearson X^2 used)

younger pregnant women (24 years and below) than the older ones. This is consistent with the findings of Fleming *et al.* (1986) in their studies on the prevention of anaemia in pregnancy in primigravidae in the Guinea

Savannah of Nigeria. The young pregnant women are more likely to have low pregnancy iron status because of their greater iron requirements and so will remain iron deplete during pregnancy. Milman *et al.* (1999) have shown that it is difficult to replenish depleted iron stores once pregnancy sets in.

The effect of educational level on the prevalence of IDA among pregnant women showed that the less educated (the no formal and primary education groups) had a higher prevalence of IDA than those with secondary and post secondary education. The less educated are the ones less likely to maintain proper hygiene and sanitation and so will fall easy prey to infections. Helminth and chronic infections have been shown to aggravate IDA (Allen, 2005).

Results obtained in this study showed that parity did not have any effect on the prevalence of IDA among the pregnant women. In a previous study by the authors (unpublished findings) parity was found to affect incidence of Protein Energy Malnutrition (PEM) among these pregnant women with those having lower parity being more malnourished. Hence although increase in parity increases weight gain (Ogbeide *et al.*, 1994), thus reducing prevalence of PEM, it does not seem to have a similar effect on iron status of pregnant women.

Regarding the effect of child spacing on the prevalence of IDA among pregnant women, the pregnant women with child spacing of less than 1 year and 1-1.5 years had significantly lower mean Hb and higher prevalence of anaemia than those with child spacing of more than 1.5 years. In a previous study, child spacing was found not to have any effect on the incidence of PEM among these pregnant women (unpublished findings). It therefore seems that the negative effects on nutritional status of frequent cycles of pregnancy and lactation are more pronounced with regards to iron status than energy status. This would be consistent with the observation that even when food intake is adequate, it may take up to two years to replenish body iron stores after a pregnancy (WHO, 1992).

In conclusion, results from this study indicate that IDA remains a major public health problem in Nigeria especially in the rural areas and the groups at greater risk include the younger women, the women with lower levels of education and those with frequent cycles of pregnancy and lactation. Mason *et al.* (2005) observed that there has not been any significant improvement in the global incidence of anaemia during the past 15 years because few countries have significant large scale programmes to address the condition.

It is therefore necessary that the Federal Government institutes well planned and designed national intervention programmes to address the problem of IDA with particular attention paid to the rural areas and the groups at greater risk. Such intervention programmes should include nutrition education programmes to improve dietary quality, micronutrient fortification of staple foods, improved sanitation and health care services including routine deworming programme. Micronutrient supplements should be given not only to pregnant women but also to adolescent girls and non pregnant women of reproductive age. (Czeizel, 1998) has shown that micronutrient supplementation at the periconceptional period improves fertility and maternal health and also maximizes reduction in birth defects.

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