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Assessment of Iron, Selenium and Zinc Status of Pregnant Women in Obio-Akpor LGA Rivers State

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Abstract: This research work was carried out to assess the mineral status (iron, selenium and zinc) of pregnant women in Obio-Akpor LGA. The study is a cross sectional survey. Two hundred pregnant women were randomly selected from health centers, public and private clinics providing ante-natal care from three communities in Obio-Apor LGA. Biochemical assessment of iron, selenium and zinc were obtained using standardized procedures. The questionnaire was coded and entered into computer using the statistical package for social sciences (SPSS) version 18. The data were analyzed using descriptive statistics. Chi-square analysis was used to identify variables that had a significant role in influencing micronutrient (iron, selenium and zinc) status. The study showed that 40% of the pregnant women were iron deficient and 97.3% were zinc deficient. No case of selenium deficiency was identified in the present study. Chi-square analysis showed that there was significant association between occupation of women and zinc deficiency ($p = 0.026$). Pregnancy age and zinc deficiency had a significant association ($p<0.05$) in the pregnant women studied. The high prevalence of iron and zinc deficiency observed in the pregnant women is disturbing and alarming, suggesting a period that requires serious nutrition intervention.

Key words: Assessment, pregnant women, rivers state, iron, selenium, zinc

INTRODUCTION

Micronutrients encompass vitamins and minerals which are essential for human development and functioning and are needed in small amounts. Trace elements are well known to play an important role in the maintenance of health. Micronutrient malnutrition is primarily related to inadequate dietary intake and pregnancy places women at risk of nutritional problems due to increased need for macro and micronutrients (Meran *et al*., 2003). Deficiencies of micronutrients (iron, selenium and zinc) during pregnancy continue to be a problem of considerable magnitude in most developing countries of the world (UNICEF, 2009). Having a child remains one of the biggest health risks for women especially in the developing countries. Fifteen hundred women (1,500), die every day while giving birth, which is a half a million mothers every year (UNICEF, 2009). In Nigeria, the maternal mortality ratio is 1,100 deaths per 100,000 live births and the lifetime risk of maternal death, at 1 in 8 (UNICEF, 2009). Iron is essential for regulation of cellular growth and differentiation (Dallman, 1987). Iron deficiency anemia, especially the more severe form has been shown to the associated with increased maternal mortality, even mild iron deficiency anemia may increase the rate of premature delivery and prenatal mortality (Carriaga *et al*., 1991). Maziya-Dixon *et al*. (2003) reported a prevalence rate of 35%in pregnant women in Nigeria.

Zinc is required for cellular division and differentiation and is an essential nutrient for normal embryogenesis (Nishi, 1996). Zinc deficiency was reported as 43% in pregnant women in a food consumption and nutrition survey in Nigeria (Maziya-Dixon *et al*., 2003). Selenium is of great importance because of the significance of selenium for fetus growth and antioxidant protection of neonates (Combs and Combs, 1984). The prevalence of selenium deficiency in the world is not documented since there are a few large scale surveys that have been conducted in respect to selenium.

Objectives of the study:

(i) assess iron, selenium and zinc status in pregnant women in Obio-Apor LGA using biochemical method;
(ii) determine the relationship between socioeconomic and demographic variables on selected micronutrients status among the pregnant women.

MATERIALS AND METHODS

Study area: The study is a cross sectional survey conducted in Obio-Akpor Local Government Area of Rivers State. Obio-Akpor Local Government Area is in the metropolis of Port-Harcourt. It is an oil mineral producing zone in Nigeria. Due to the presence of oil companies in the area, most people in Obio-Akpor are oil company workers, civil servants, traders, business men and women. Although there are few people who engage in small scale agricultural practices such as cassava cultivation, maize, vegetables, yam and cocoyam.

Sample size: UNICEF (2009) reported that the prevalence of maternal mortality in Nigeria is 30%. The proportion formula for determination of the sample size was used to get the sample size. The formula is as follows:

Ns = $(Z/E)^2$ x P (1-P)
Ns = Sample size
Z = Standard Z score (1.96 using a confidence level of 95%)
E = Proportion of sample error in a given population i.e., 5%
P = Estimated proportion of cases in the population
Therefore, p = 30% = 30/100 = 0.30
N = $1.96/0.05)^2$ x 0.30 x 0.70
NS = 164.6

The sample size calculated using the statistical formula was 164.6. Twenty percent of the sample size was calculated and added to the number and was approximated to 200 respondents to make room for drop-outs or incorrectly filled questionnaires.

Sample population: Two hundred pregnant women were randomly selected from health centers, public and private clinics providing ante-natal care from three communities in Obio-Akpor Local Government Area for the survey.

Data collection: The survey component assessed the socio-economic and demographic characteristics of the respondents using a structured questionnaire. Two hundred pregnant women were randomly selected from health centers, public and private clinics providing ante-natal care from three communities in Obio-Akpor Local Government Area for the survey. The communities selected included Rumukurishi, Woji and Elelenwo.

Biochemical assessment of iron, selenium and zinc were obtained using standardized procedures. An experienced clinic phlebotomist obtained up to 0.5 mL venous blood in twenty percent of the subjects (40). Blood samples were stored in a trace element free serum collecting tube. The blood was promptly centrifuged for 15 min at 4°C and frozen at -20°C for subsequent assays. 5 mL of pyloric acid and nitric acid were added to 0.5 mL of serum. Serum was digested with concentrated H_2SO_4 and after digestion; it was made up to 100 mL with deionized water. Atomic absorption spectrometry (Model number Buck 210/11) was used with an iron, selenium and zinc lamb to detect serum iron, selenium and zinc. Iron deficiency was defined as serum iron concentration below 50 mcg/dL. Selenium deficiency was defined as serum selenium concentration below 10 mcg/L. Zinc deficiency was defined as serum zinc concentration below 70 mcg/dL.

Ethical approval and consent forms: This study was made possible by the approval of members of the ethical committee of Obio-Akpor Local Government Area, Rivers State. The respondents were provided with informed consent form signed by each of them before the study was carried out. The participants were sufficiently guided and assisted by the researcher in the completion of the questionnaires. There was no monetary reward for participating in the study.

Data analysis: The questionnaire was coded and entered into computer using the statistical package for social sciences (SPSS) version 18. The data were analyzed using descriptive statistics (frequency, percentages, mean and standard deviation). Cross tabulation and Chi-square analysis were used to identify socioeconomic and demographic variables that had an association with the prevalence of micronutrient deficiencies in the pregnant women. Significance was accepted at $p<0.05$.

RESULTS

Table 1 shows the general characteristics of the pregnant women. More than half of the respondents (64%) were between the ages of 21-30 years. The pregnancy age of women varied. However, majority of the women studied (48.5%) were in their last trimester and about 12.0% were in their first trimester. Most women (37.5%) were first timers (nulliparous) in pregnancy; about 7% of the women have had multiple pregnancies of five to eight. A higher proportion of women (42.5%) got married between the ages of 21-25 years; only a few women got married between 36-40 years.

Table 2 presents the socioeconomic characteristics of the pregnant women. Most respondents in the study (61%) had secondary school education, about 29% had tertiary education and only a few of them (10.0%) had little or no education. Most of the women studied (44%) were not employed. About 34.5% were traders/business women.

Figure 1 shows the iron, selenium and zinc status of the pregnant women studied. Forty percent of the pregnant women had iron deficiency. About 97.5% were zinc deficient. Selenium deficiency was not observed in the women studied.

In the prevalence of micronutrient (iron, selenium and zinc) deficiency by age of respondents (Fig. 2), iron deficiency (50%) was common in pregnant women aged 21-30 years. Pregnant women aged below 20 years had the least prevalence (12.5%) of iron deficiency. Age of women did not have an effect on iron deficiency ($\chi^2 = 1.111$; df = 2; p = 0.574). Women between the ages of 21-30 years had the highest number and percentage (59.0%) of zinc deficiency. Women between the ages of 31-40 years had a prevalence rate of 30.8%, while women below 20 years recorded 10.3% of zinc deficiency. The chi-square analysis showed that there was no significant difference between zinc deficiency

Table 1: Characteristics of the respondents studied.

		------ Frequency ------	
Variable	Classification	No	%
Age of women (years)	Below 20	25	12.5
	21-30	128	64.0
	31-40	47	23.5
	Total	200	100
Age of pregnancy	First trimester	24	12.0
	Second trimester	79	39.5
	Third trimester	97	48.5
	Total	200	100
Number of pregnancy	One	75	37.5
	Two	51	25.5
	Three	32	16.0
	Four	28	14.0
	5-8	14	7.0
	Total	200	100
Age at marriage (years)	16-20	57	28.5
	21-25	85	42.5
	26-30	49	24.5
	31-35	8	4.0
	36-40	1	0.5
	Total	200	100

Table 2: Socioeconomic characteristics of the respondents

		------- Frequency -------	
Variable	Classification	No	%
Level of education	No formal education	7	3.5
	Primary	13	6.5
	Secondary	122	61.0
	Tertiary education	58	29
	Total	200	100
Occupation	Trader/business	69	34.5
	Civil servant	19	9.5
	Farmer	2	1.0
	Not employed	88	44.0
	Other professions (Oil worker/lawyers)	22	11.0
	Total	200	100

and age of respondents (χ^2 = 0.684; df = 2; p = 0.710). No statistics was computed for selenium deficiency because selenium deficiency was not observed.

Table 3 shows that pregnant women with secondary education (62.5%) had the highest prevalence of iron deficiency. Approximately 37.5% (of women with tertiary education were iron deficient. There was no significant relationship between women's education and iron deficiency (χ^2 = 3.294; df = 3; p = 0.349). Women with secondary education (64.1%) had the highest prevalence of zinc deficiency. Womens' education had no effect on the prevalence of zinc deficiency in the pregnant women studied (χ^2 = 0.552; df = 4; p = 0.968). No statistics was computed for selenium deficiency because selenium deficiency was not observed.

The prevalence of iron deficiency was more in pregnant women (50%) who were unemployed, followed by the traders/businesswomen (31.2%) and lowest (18.8%) in women in other professions. Mothers' occupation had no effect on their iron status (χ^2 = 3.079; df = 3; p = 0.380). Mothers who were not employed had the highest prevalence of zinc deficiency (46.2%). Mothers who were civil servants had the least percentage (7.7%) of zinc

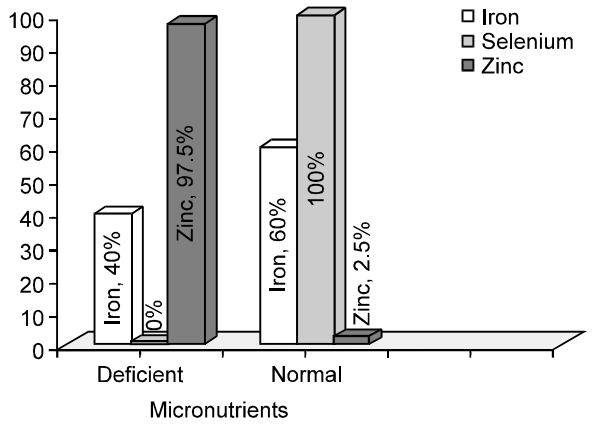

Fig. 1: Iron, selenium and zinc status of pregnant women studied

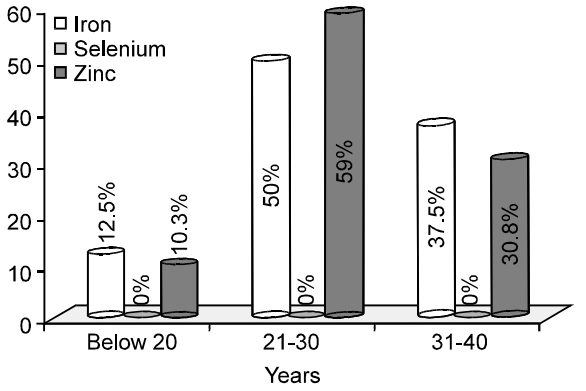

Fig. 2: Prevalence of iron, selenium and zinc deficiency by age of respondents

deficiency. The chi-square analysis showed that there was significant association between occupation of women and zinc deficiency (χ^2 = 9.231; df = 3; p = 0.026). No statistics was computed for selenium deficiency because selenium deficiency was not observed.

Table 4 shows that the prevalence of iron deficiency in the pregnant women studied was highest in women who got married between the ages of 21-25 years (31.2%), women who got married at the age of 31-40 were the least iron deficient (6.2%). Age at marriage did not affect iron deficiency in the women studied (χ^2 = 3.577; df = 4; p = 0.466). Women who got married between the ages of 21-25 years had the highest prevalence (41%) of zinc deficiency. There was no significant difference between age at marriage and zinc deficiency in the women studied (χ^2 = 1.388; df = 4; p = 0.846). Again no statistics was computed for selenium deficiency because selenium deficiency was not observed.

About (56.2%) of women in their third trimester were iron deficient, followed by (37.5%) in their second trimester and (6.2%) in their first trimester. Although more women

Table 3: Effect of Womens' education and occupation on the prevalence of iron, selenium and zinc in the respondents studied

		---------- Iron ----------		------ Selenium -------		---------- Zinc ----------	
Variable	No. examined	No	%	No	%	No	%
Mothers' level of education							
No formal education	1	0	0	-	-	1	2.6
Primary	1	0	0	-	-	1	2.6
Secondary	26	10	62.5	-	-	25	64.1
Tertiary education	12	6	37.5	-	-	12	30.7
Total	40	16	100	-	-	39	100
Mothers' occupation							
Trader/businesswoman	12	5	31.2	-	-	12	30.8
Civil servant	4	0	0	-	-	3	7.7
Not employed	18	8	50.0	-	-	18	46.2
Other professions	6	3	18.8	-	-	6	15.4
Total	40	16	100	-	-	39	100

Age at marriage: iron (χ^2 = 3.577; df = 4; p = 0.466); zinc (χ^2 = 1.388; df = 4; p = 0.846)
Pregnancy age: iron (χ^2 = 2.704; df = 2; p = 0.259); zinc (χ^2 = 5.812; df = 2; p = 0.055)

in their third trimester had a high prevalence rate of iron deficiency, pregnancy age did not have a significant effect on iron deficiency (χ^2 = 2.704; df = 2; p = 0.259). Women in their second and third trimester (43.6 and 43.6%, respectively), had the highest percentage of zinc deficiency. The chi-square analysis showed that there was a significant association between pregnancy age and zinc deficiency in the pregnant women studied (χ^2 = 5.812; df = 2; p = 0.055). No statistics was computed for selenium deficiency because selenium deficiency was not observed.

DISCUSSION

More women who participated in the study (64%) were in the 21-30 year age group. Thirty eight percent (38%) of the women studied were getting pregnant for the first time or had only one to two children. This could be attributed to the harsh economic condition experienced in the country and the fact that educated mothers were likely to end up with lower number of children because of their knowledge on family planning methods and low fertility lifetime. Forty two percent (42%) got married within the ages of 21-25. This could be attributed to the fact that education delayed marriage and first births (Kurz *et al*., 1994). This finding is similar to a recent National Demographic and Health Survey (2008) publication which showed that almost half of the women in Nigeria were married by age 18. The level of illiteracy was higher in the women (10%) than in their husbands (4.5%). The higher level of illiteracy observed in the women could be as a result of parents' refusal to educate their female children. The more unemployed women (44%) observed in this study could be because most women were in their child bearing stage. This study suggests that the prevalence of iron deficiency is high among the pregnant women, affecting a quarter (40%) of the women. This finding is consistent with the survey conducted by Maziya-Dixon *et al*. (2003) which reported a high prevalence (35.3%) of iron deficiency in pregnant women in Nigeria. The study revealed that none of the pregnant women were selenium deficient. This could be attributed to the fact that very little selenium is needed for good health and most people can get adequate amounts through diet alone (Http://www.ncbi.com). There was a high prevalence of zinc deficiency (97.5%) among the pregnant women. Zinc deficiency prevalence recorded in this study is higher than (43%) reported by the NDHS (2008) and higher but closer to 73.5% recorded among pregnant women in rural area of Hayarna State of India (Pathak *et al*., 2004). The high prevalence of zinc deficiency among pregnant women in the present study may be due to inadequate dietary intake of foods rich in zinc. Studies conducted in India and other developing countries have documented zinc deficiency in pregnant women due to less intake of dietary zinc (Pathak *et al*., 2004) and (Keen *et al*., 2003). The present study was undertaken in a region where the staple foods were tubers and cereals. The presence of higher amount of phytates and dietary fibre in such diets, are known to cause poor zinc absorption (Sandstead, 1995). This could be a major contributing factor for the high prevalence of zinc deficiency in the study population. Poor pre-pregnancy nutritional status and low serum levels could be other contributing factors leading to low serum zinc levels during pregnancy (Sandstorm, 2001). Studies have documented a negative effect of supplemental iron on plasma zinc level in both animal and human studies (O'Brien *et al*., 2000) during pregnancy and lactation (Fung *et al*., 1997). In spite of the fact that women from high socioeconomic background had better iron status than women from low socioeconomic background, there was no significant effect ($p>0.05$) between socioeconomic/demographic variables and the prevalence of iron deficiency in the pregnant women studied. Pregnancy age and occupation of women significantly affected ($p<0.05$) the zinc status of the pregnant women studied. The result showed a meaningful difference in the prevalence of iron and zinc deficiency and age groups. Women aged 21-30

years were more iron and zinc deficient than women less than 20 years and 31-40 years. Hence one would have thought that women in age group less than 20 are yet to experience any appreciable iron and zinc depletion due to reproductive events, the women above 30 years are most likely to be multiparous and are more likely to experience iron and zinc deficit. However, there was no significant difference ($p>0.05$) between the mothers age and iron and zinc deficiency. Mothers who had secondary education had the highest prevalence of iron and zinc deficiency. This could be attributed to their poor knowledge on nutrition. Iron and zinc deficiency was not influenced ($p>0.05$) by the mothers' education. Women who were not employed had the highest prevalence of iron and zinc deficiency and this could be because they did not have the resources to afford the variety of foods rich in iron and zinc. There was a significant association between mothers occupation and the prevalence of zinc deficiency ($p = 0.026$). Iron and zinc deficiency represents long term micronutrient malnutrition and is frequently associated with inadequate nutrient intake and poor overall economic condition.

Conclusion: Forty percent of the pregnant women were iron deficient. This is to say that four out of every ten women studied were iron deficient. The high prevalence of iron deficiency in the pregnant women studied could be attributed to low dietary intake, malabsorption and interactions during supplementation. Ninety seven percent (97.3%) of the respondents were zinc deficient that is to say that nine out of every ten women were zinc deficient. The high prevalence of deficiency could also be attributed to low dietary intake. The high prevalence of zinc deficiency observed in the pregnant women in this study is disturbing and alarming, suggesting a period that requires serious nutrition intervention. Early and progressive decline in serum zinc occurs during pregnancy and a poor maternal zinc status may limit the metabolic adaptation capacity of women especially during pregnancy. Chi-square analysis showed that occupation of women and pregnancy age had a significant association ($p<0.05$) with the iron and zinc status of the pregnant women studied. The study revealed that none of the pregnant women were selenium deficient, they had adequate selenium status.

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