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Research Article

Pervasiveness of Anaemia and Vitamin A Deficiency among Females Aged 15-45 Years in Urban and Riverine Rural Areas of Anambra State, Nigeria

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Abstract

Background and Objective: Micronutrient deficiencies among females has posed both health and economic challenges in the developing countries of the world. The present study assessed the prevalence of anaemia and vitamin A deficiency among females in urban and riverine rural communities in Anambra State, Nigeria. **Materials and Methods:** A total of 586 females aged 15-45 years participated in the study. The participants filled a self-reported questionnaire which covered items related to anaemia, vitamin A and frequency of consumption of iron and vitamin A rich foods. Serum iron and retinol levels of sub-sample of participants were measured. Descriptive and inferential statistics were used to analyze the data using SPSS, version 22. Significance was set at $p<0.05$. **Results:** Results showed that 40.0% of the respondents were retinol deficient. More than half (63.3%) were anaemic out of which 26.6 and 5.0% had moderate and severe anaemia, respectively. About 46.0% of the urban respondents had low serum retinol compared to 33.3% of their rural counterparts. There was no significant ($p>0.05$) relationship between location and the respondents' serum retinol and iron status. Overall, daily consumptions of meat, fish and vegetables were low in the urban and riverine rural communities (24.7% vs. 21.7%, 20.3% vs. 28.0% and 51.3% vs 48.2%, respectively). Many (78.7%) respondents in riverine rural area reported skipping meals. **Conclusion:** Anaemia, vitamin A deficiency and low consumption of micronutrient rich foods were observed among the respondents. Behaviour change communication is required to improve the micronutrient status of the women.

Key words: Micronutrient, women of childbearing age, anaemia, vitamin A, retinol deficiency

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Micronutrient deficiencies also known as hidden hunger is one of the spectra of malnutrition. Scientific evidence showed that hidden hunger is responsible in part for the global malnutrition burden[1]. Hidden hunger has been linked with impair growth and development in foetus and children, low productivity in adults and increase in morbidity and mortality rates in all age groups[2]. Women of childbearing age are at increased risk of micronutrient deficiencies due to the high physiological demands, poor dietary habits and socioeconomic factors such as educational status, women empowerment, cultural beliefs, intra household food distribution and social norms[3]. These factors are key determinants of access to adequate and nutritious food, dietary behaviours and nutritional status.

Iron deficiency is among the most important micronutrient deficiencies that are of major public health concern. It was reported that more than 2 billion people globally have micronutrient deficiencies particularly vitamin A, iodine, iron and zinc[1]. Iron deficiency leads to microcytic anaemia, decreased capacity to work as well as impaired immune and endocrine function[2]. According to the WHO[4] iron deficiency anaemia is a major nutritional problem affecting girls and women in sub-Saharan Africa. More than 38% of all women of childbearing age in the African region are anaemic[4]. In Nigeria, more than 58% of women in that age bracket are anaemic with 62 and 54% in rural and urban areas, respectively[5]. An earlier study, showed 25.6% prevalence of iron deficiency and anaemia among non-pregnant women in Zaria, North Central Nigeria[6].

Iron deficiency has been attributed to inadequate consumption of staple iron-rich foods with its consequent wide spread mortality and morbidity in children and women of childbearing age in Africa including Nigeria[7]. Pregnancy complications, miscarriages, pre-matured babies and low birth weight infants are all attributes of iron deficiency anaemia[8,9]. The contributing factors reported by Lozoff *et al.*[10] included poor dietary practices due to socio-cultural food taboos, infection, malabsorption, malaria and increased foetal demand for pregnant women. Black *et al.*[11] reported that about 23% of maternal deaths are indirectly linked to anaemia during pregnancy. Low haemoglobin (Hb) concentration or haematocrit limit which defines anaemia depends on age-group and physiological condition of an individual. For non-pregnant women, the limit is Hb <120 g L^{-1} or haematocrit <36% and for pregnant women the limit is Hb <110 g L^{-1} or haematocrit <3%[12].

Vitamin A deficiency is also a major public health problem in Sub-Saharan Africa[13]. It increases the risk of maternal mortality, impairs immune function and cell differentiation[4]. According to the Nigeria food consumption and nutrition survey the national prevalence of vitamin A deficiency (VAD) was estimated to be 29.5% among preschoolers and 13% among women of childbearing age[14]. The most common symptoms of vitamin A deficiency include xerophthalmia, increased risk of measles, diarrhea and acute respiratory infections. Vitamin A deficiency also increases the risk of mortality and infections even before the onset of xerophthalmia.

Gender biases influence food consumption and distribution in families with women being the last recipient of food both in quality and quantity[15]. In a patriarchal society like Nigeria, the choice of women as the target group for this study is justified. This study therefore assessed the prevalence of anaemia and vitamin A deficiency among females aged 15-45 years in urban and riverine rural areas of Anambra State, Nigeria.

MATERIALS AND METHODS

Study area: The study was conducted in the Anambra State, South-East Nigeria. Anambra State has 21 Local Government Areas (LGAs). The State has an area of approximately 4,844 km^2 with an estimated population of 4,177,828 based on the 2006 census figure[16]. The indigenes are mainly Igbos (98%). The inhabitants of the rural/riverine part of Anambra State are mainly farmers and fishermen while those of urban area are mainly civil servants and traders.

Study design: The study design was a cross sectional descriptive survey.

Population of the study: The study population was made up of women of childbearing age (15-45 years) in Awka, Ihiala, Atani and Nsugbe in Anambra state. Awka and Ihiala are the urban communities while Atani and Nsugbe are the riverine rural communities. The total number of females in these communities was 253,003[17].

Sampling techniques: A multistage sampling technique was used to select the respondents for the study. The State was stratified into three senatorial districts and one LGA was selected from each of the three senatorial districts in the State using a purposive sampling procedure. Four (2 urban and 2 riverine rural) communities were further selected from the selected LGAs. The selected communities were categorized into rural (Atani and Nsugbe) and urban (Ihiala and Awka) areas. One household was selected from every three households in the communities through a systematic sampling technique.

In the final stage, one female (aged 15-45 years) was selected from each of the households and a total number of 600 respondents were selected in both the rural and urban communities using proportionate sampling technique.

Sample size determination: The sample size was calculated using a formula described by Yamane[18].

$$n = \frac{N}{1 + N(e)^2}$$

N = Population size
e = Error or level of precision = 5% or 0.05
n = Sample size

Using Yamane[18] formula, a sample size of 399 was gotten, which was increased by 50% (200) to have a representative sample size. This gave a total sample size of 599. However, a total number of 600 respondents (300 urban and 300 rural) were recruited for the study but 13 respondents in the rural area did not complete the study. A total of 586 completed questionnaires were analyzed. A sub-sample of 60 respondents ($\approx$10% of the sample size) was randomly selected for biochemical evaluation.

Ethical clearance: The study followed all guidelines for human research. Ethical approval was obtained from the Ethical Clearance Board of University of Nnamdi Azikiwe Teaching Hospital, Awka, Anambra State, Nigeria.

Informed consent: Formal approval was obtained from the community leaders in the urban and rural communities for permission to allow their subjects to be used in the study. The purpose and full details of the study were explained to the leaders and the respondents who gave written consent to participate in the study.

Data collection: Data were collected using questionnaire, anthropometric measurements and biochemical analysis. A structured questionnaire validated for content by 5 lecturers in the Department of Nutrition and Dietetics, University of Nigeria, Nsukka was used to collect information. Its reliability was ascertained by pretesting it on 100 subjects randomly selected from Nnewi South LGA which was not sampled in the study and a reliability index of 0.9 was obtained. The questionnaire covered items related to anaemia, vitamin A and frequency of consumption of iron and vitamin A rich foods.

Biochemical analysis: The blood samples were collected from the sub-sample (60 women) by phlebotomist. The blood samples were taken from the forearm and back of palm depending on the access point of each respondent using sterile disposable hypodermic needle and 5 mL syringes after the access points had been cleaned with alcohol and air dried. Each blood sample was transferred into Ethylenediaminetetraacetic acid (EDTA) bottle mix properly with the anticoagulant. The specimen were kept in the cooler box and protected from sunlight before transporting to laboratory at Nnamdi Azikiwe University Teaching Hospital Nnewi (NAUTH) for analysis within 12 hrs.

Haemoglobin determination: Each blood sample (0.002 mL) was diluted (1:250 dilutions) with 5 mL of Drabkin's solution in a test tube, mixed well and left to stand for 10 min at room temperature (25.01 °C). Absorptometer using 5 mL of Drabkin's solution as a blank was used to measure the absorption at 540 manometers (for full colour development). This compensated for the yellow colour of the solution. A standard solution of cyanmethaemoglobin was read in the same way.

Calculation:

$$\text{Haemoblobin}\left(\frac{\text{g}}{\text{dL}}\right) = \frac{\text{Reading of test}}{\text{Reading of standard}} \times \frac{\text{Dilution factor} \times \text{conc. of standard (mg / 100 mL)}}{1000}$$

Anaemia was classified using the Hb level as proposed by WHO[12].

Serum retinol determination: The blood samples were each, made up to 500 μL^{-1} in volume with ultrapure water. Ascorbic (10 g L^{-1}) was added as an antioxidant and the samples shaken for about 15 min. Another 400 µL of acetonitrile and hexane was also added to the samples and centrifuged for 2 min at 800 RPM. Thereafter, the supernatant was collected for vitamin A (retinol) determination on HPLC[19].

Analysis of data: Anaemia was diagnosed using the WHO[12] recommended cut-off for non-pregnant women ($\geq$15 years) as 12 g dL^{-1} and above(normal), 11.0 g dL^{-1} to11.9 g dL^{-1} (mild anaemia), 8.0-10.9 g dL^{-1} (moderate anaemia) and $<$ 8.0 g dL^{-1} d (severe anaemia). The serum retinol (SR) was also categorized using the WHO[20] criteria of <10 μg dL^{-1} as deficient, 10-<20 μg dL^{-1} as low and 20-30 μg dL^{-1} as normal SR.

Statistical analysis: The data obtained from the questionnaire and biochemical evaluation were analyzed using descriptive and inferential statistics. The IBM SPSS, version 22.0 was used. Chi-square test was used to measure the relationship among location, SR and iron status of the respondents. Significance was set at $p<0.05$.

RESULTS

Figure 1 shows the age distribution, educational and marital status of the respondents. It is observed that 51.7 and 42.3% of the urban and rural women, respectively were within the age of 35-45 years. Women with no formal education was more in rural (19.6%) than urban areas (9.3%), whereas women with the highest educational level was more in urban (36.0%) than rural areas (20.3%). Data on marital status showed that married women were more in rural (56.6%) than urban areas (49.7%).

Table 1 outlines the frequency of meal, fruit and vegetable consumption of the respondents. It is found that 48.0% of the urban and 47.2% of the riverine rural women ate only twice daily, while 41% of urban and 14.3% of rural women ate three times daily. Most urban women (64.7%) consumed fruits 2-3 times a week and 60.9% of rural women consumed fruit only when in season. Fruits were mainly consumed alone by 62.0% of the riverine rural and 79.7% of the urban women. Vegetable was eaten daily by 51.3% and 48.2% of the urban and the rural respondents, respectively.

Table 2 delineates the frequency of meat, fish, milk and milk product consumption of the respondents. Meat was eaten as regular food by the 33% of the urban and 14% of the rural respondents. Fish was eaten mainly on weekly basis by 37.3% of the urban and 20.8% the rural respondents. Milk was consumed fortnightly by urban women (33.3%) and monthly by rural women (34.3%). Daily consumption of milk products was the lowest in both urban (6.7%) and rural (1.7%) areas.

The prevalence of anaemia among the study population was 63.3% (Fig. 2). More than one quarter (31.7%) of the respondents had mild anaemia, while 26.6% and 5.0% were moderately and severely anaemic, respectively (Fig. 3).

Table 3 shows the mean Hb levels of the respondents in urban and rural areas according to category of anaemia and age-group. Out of the 22(73.3%) rural women who were anaemic, 11(36.7%) had mild anaemia (11.42 g dL^{-1}), 9(30%) had moderate anaemia (9.43 g dL^{-1}) while 2 (6.6%) had severe anaemia (7.8 g dL^{-1}). The respondents within the age of 35-45 years had the highest mean Hb level (10.73 g dL^{-1}) in the urban area while the respondents with the age of 24-34 years had the highest Hb level (10.44 g dL^{-1}) in the rural area. There was no significant relationship between location and the Hb level of the respondents.

Table 4 shows that 16.7% of urban and 23.3% of rural respondents were deficient in vitamin A. The rural (33.3%) and urban (46.7%)respondents had low serum retinol values. When stratified according to age-group, the highest mean serum retinol level was found among the age group of 25-34 years in both urban (19.88±5.79 μg dL^{-1}) and rural (19.10±5.43 μg dL^{-1}) areas. There was no significant relationship between location and the serum retinol status of the respondents.

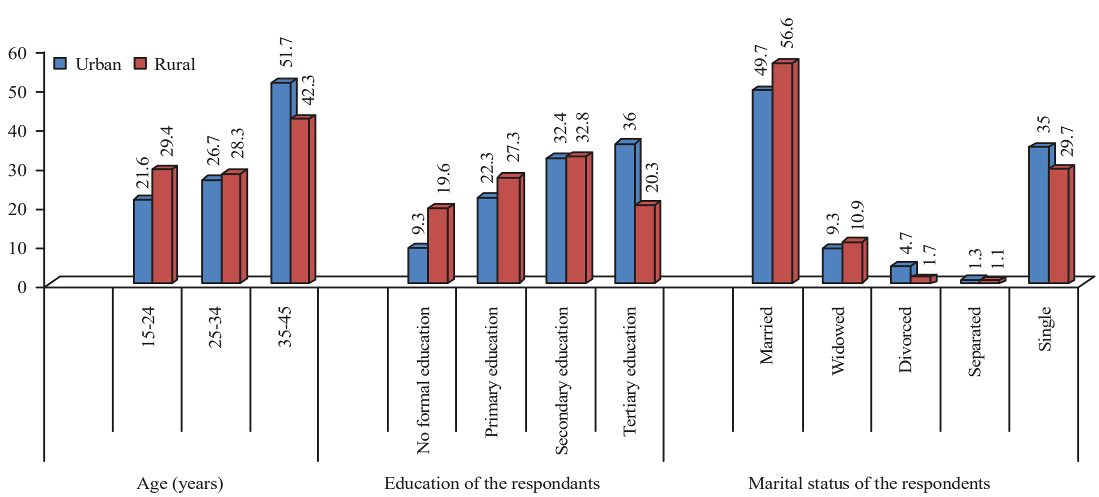

Fig. 1: Age distribution, education and marital status of the respondents

Table 1: Frequency of meal, fruits and vegetable consumption

	Urban		Riverine rural	
Frequency of consumption	Frequency	Percentage	Frequency	Percentage
Meal consumption				
Once	29	9.7	90	31.5
Twice	144	48.0	135	47.2
Thrice	123	41.0	41	14.3
More than thrice	4	1.3	20	7.0
Total	300	100	286	100
Fruit consumption				
Every day	106	35.3	54	18.9
2-3 times a week	194	64.7	43	15.0
Once a week	00	00	15	5.2
When in season	00	00	174	60.9
Total	300	100	286	100
How fruit is consumed				
With regular meals	114	38.0	58	20.3
Alone	186	62.0	228	79.7
Total	300	100	286	100
Vegetable consumption				
Daily	154	51.3	138	48.2
Weekly	63	21.0	59	20.6
Occasionally	58	19.3	48	16.8
Rarely	25	8.3	41	14.3
Total	300	100	286	100

Table 2: Frequency of meat, fish and milk consumption

	Urban		Riverine rural	
Frequency of consumption	Frequency	Percentage	Frequency	Percentage
Meat consumption				
Daily	74	24.7	62	21.7
Weekly	93	31.0	90	31.4
Occasionally	35	11.7	94	32.9
As regularly as food is eaten	98	32.6	40	14.0
Total	300	100	286	100
Fish consumption				
Daily	61	20.3	80	28.0
Weekly	112	37.3	58	20.3
Occasionally	43	14.3	44	15.4
As regularly as food is eaten	84	28.0	104	36.3
Total	300	100	286	100
Milk consumption				
Daily	89	29.7	31	10.8
Every other day	39	13.0	47	16.4
Weekly	31	10.3	29	10.1
Fortnightly	99	33.0	24	8.4
Monthly	24	8.0	98	34.3
I do not take milk	18	6.0	57	20.0
Total	300	100	286	100
Milk product consumption				
Daily	20	6.7	5	1.7
Every other day	71	23.7	27	9.4
Weekly	55	18.3	28	9.8
Fortnightly	43	14.3	32	11.2
Monthly	111	37.0	167	58.4
Others	00	00	27	9.4
Total	300	100	286	100

Table 3: Mean hemoglobin levels of respondents in urban and rural areas according to category of anaemia and age-group

	Urban		Riverine rural	
Variables	Mean Hb level (g dL^{-1})	F (%)	Mean Hb level (g dL^{-1})	F (%)
Category of anaemia				
Normal	12.6±0.464	14 (46.7)	12.45±0.30	8 (26.7)
Mild	11.39±0.26	8 (26.7)	11.42±0.27	11 (36.7)
Moderate	9.53±0.189	7 (23.3)	9.43±0.1	9 (30.0)
Severe	7.8	1 (3.3)	7.8±0.14	2 (6.6)
Age-group (years)				
15-24	10.58±0.57	13 (43.3)	10.28±0.72	11 (36.7)
25-34	10.70±1.25	9 (30.0)	10.44±0.85	12 (40.0)
35-45	10.73±1.25	8 (26.7)	10.0±1.22	7 (23.3)

F (%): Frequency percentage

Table 4: Serum retinol classification of the respondents according to location and age-group

Variables	Urban				Riverine rural			
Age-group (years)	Normal F (%)	Low F (%)	Deficient F (%)	Mean SR (μg dL^{-1})	Normal F (%)	Low F (%)	Deficient F (%)	Mean SR (μg dL^{-1})
15-24	3 (23.1)	7 (53.8)	3 (23.1)	16.85±5.05	4 (36.4)	5 (45.5)	2 (18.2)	15.36±4.92
25-34	5 (55.6)	3 (33.3)	1 (11.1)	19.88±5.79	7 (58.3)	3 (25.0)	2 (16.7)	19.10±5.43
35-45	3 (37.5)	4 (50.0)	1 (12.5)	18.82±6.74	2 (28.6)	2 (28.6)	3 (42.9)	15.71±7.19
Total	11 (36.7)	14 (46.7)	5 (16.7)		13 (43.3)	10 (33.3)	7 (23.3)	

SR: Serum retinol, SR classification: Normal = 20 -30 μg dL^{-1}, Low: 10-<20 μg dL^{-1}, Deficient: <10 μg dL

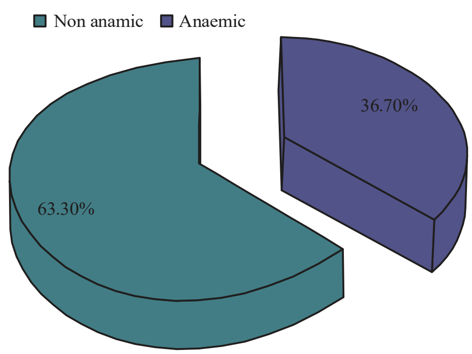

Fig 2: Prevalence of anaemia among respondents

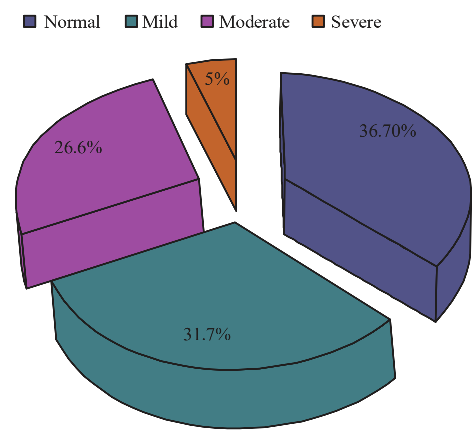

Fig 3: Categories of anaemia among respondents

DISCUSSION

This study assessed the prevalence of anaemia and vitamin A deficiency among females aged 15-45 years in urban and rural areas of Anambra State, Nigeria. Low consumption of micronutrient rich foods was recorded among women in the study area. Surprisingly, rural riverine women had lower consumption of fruits and vegetables despite their availability in the area. Various reasons have been reported for the inadequate nutrient intake among women. According to Patil, *et al.*[21] women were forced to abstain from some nutritious foods due to traditional food habits even when foods were available in abundance. Level of nutrition knowledge and preference were also important factors that influenced the dietary practices of households[22].

The prevalence of anaemia in this study ranged from 53.3-73.3% in urban and rural riverine areas, respectively, with an average of 63.3%. This finding is higher than the prevalence reported among women in other African countries. In Ethiopia, anaemia prevalence among women aged 15-49 years was 24%[23]. According to Hakizimana *et al.*[24], in Rwanda prevalence of anaemia among women of reproductive age was 19.2%. Also in Nepal and South Asia, about 41% of women aged 15-49 years were anaemic of which 33% had mild anaemia[25]. Earlier studies in Nigeria reported lower values. In Zaria, 25.6% was reported among non-pregnant women[6].

The high prevalence of anaemia recorded among females in the study area could be attributed to the low consumption of micronutrient rich foods among the respondents coupled with the high iron requirement by this group. Another reason for the higher prevalence of anaemia could be due to inadequate absorption, nutrient interactions, or inhibition from consumption of foods of plant origin which are high in phytates. Iron deficiency occurs when ingestion or absorption of dietary iron is inadequate to meet iron losses and requirement. Although, not significant, the proportion of women who had anaemia was more in riverine rural than urban area. The reason for this could be the inadequate intake of micronutrient rich foods reported among the riverine rural respondents. In addition, rural women, most times, sell the micronutrient rich foods they produced to meet the other household needs.

The mean serum retinol concentration in the present study was low. About 16.7% of the urban and 23.3% of the riverine rural women had vitamin A deficiency whereas low serum retinol was found in 33.3% of the riverine rural and 46.7% of the urban areas. This finding is higher than the national prevalence of vitamin A deficiency (13%) among women of childbearing age as reported by Maziya-Dixon *et al*.[14]. This might be due to low consumption of animal products and/or pro-vitamin A carotenoid in plant foods. Evidence has shown that the efficacy of conversion of pro-vitamin A to retinol esters is not 100%. According to Dairo and Ige[26] the rate of conversion of â-carotene in fruits and vegetables to retinol is less than desired. The vitamin A deficiency observed in the study population could also be associated with anaemia. Individuals with low vitamin A status tend to have low iron status which can lead to anaemia[27]. However, low serum retinol in this study should be interpreted with caution as infections and other disease conditions may act as underlying causes.

There was no significant ($p>0.05$) relationship between the location of the respondents and their serum retinol and iron status. This finding is contrary to that of Rodriquez-Bernal *et al*.[28] who reported that anaemia was more in the rural than in urban areas. Poverty and ignorance (in both rural and urban communities) are the major causes of anaemia including iron deficiency instead of location as previously reported[29,30].

CONCLUSION

Prevalence of anaemia and vitamin A deficiency was high in the study area. Iron and vitamin A deficiencies and poor consumption of micronutrient rich food among rural women was more than their urban counterpart despite the availability of the food sources in the rural areas. The high prevalence of anaemia and vitamin A deficiencies considered a severe public health problem among rural women.

SUGGESTIONS

These findings call for urgent intervention through reinforcement of the various strategies already used to address anaemia and vitamin A deficiency in Nigeria. The coverage of these strategies which include nutrition education, fortification and supplementation, dietary diversification and deworming should be widened in addition to the development of ready-to-eat iron rich food products to improve consumption and bio-availability.

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