Original article

Nutrient adequacy of diets of women of childbearing age in south-east Nigeria

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Abstract. *Background and objective:* Inadequate nutrients intake by women of child bearing age (WCA) leads to reproductive health problems, resulting in maternal and infant mortality. The study aimed to evaluate nutrient adequacy of women of child-bearing age in South-east Nigeria. *Methods and study design:* In this cross sectional study, stratified random sampling and simple random sampling techniques were used to select 1200 women of child bearing age (15-49 years) from three states of South-east Nigeria. A 24-hour dietary recall questionnaire data were analysed using adapted Total Dietary Assessment (TDA) Software. Minimum Dietary diversity of Women of Childbearing Age (MDD-WCA) was calculated based on ten food groups with a cut-off point of intake at ≥5 groups. Nutrient Adequacy Ratio (NAR) was derived for energy and 11 other nutrients. *Results*: Mean age of the women was 28.2±5.6 years. BMI was 26.8±4.8 /m^2. Majority (96.3%) women were married, 41.7% were traders. Mean dietary diversity score (MDDS) was 5.78 ±1.16 and 88.3% of WCA achieved MDD-W. About 88.4% had high dietary diversity tercile (DDT) and 11.7% had low (DDT). Imo State with MDDS of (5.99±1.14) was significantly higher ($P<0.05$) than Enugu State (5.69±1.14) and Anambra State (5.64 ± 1.18). More than 50% did not meet their NAR values for Fat, calcium, vitamin C, Sodium, Potassium and Magnesium. *Conclusions:* Nutrient adequacy ratio indicated low in intake of some micro nutrients and excess intake of energy, carbohydrate and protein. Nutrition education is recommended in South-east Nigeria.

Key words: Women of childbearing age, Dietary Diversity, Nutrient Adequacy, Food groups, BMI

Introduction

Maternal under nutrition is a global problem and is still an unattended health problem in the developing countries where maternal mortality, low birth weight, and childhood stunting are the major health problems (1). Unfavourable health outcomes usually occur in situations where diets do not contain adequate nutrients for optimal health. Either deficiency or excess of one or more nutrients leads to nutritional problems (2).

Micronutrient is the term used to represent essential vitamins and minerals required from the diet to sustain normal body functions (3). Even though micronutrients are required in very small amounts, their deficiencies can have serious negative health implication and may result in death if left untreated. Micronutrient deficiencies are common among women of child bearing age in developing countries (4,5).

The Micronutrients that are critical for maternal and child health are vitamin A, iron, iodine, zinc, folic acid (6). They are common when people do not have access to micronutrient-rich foods such as fruit, vegetables, animal products, and fortified foods. Young children and women of reproductive age are the most

vulnerable population groups to vitamin A, iodine, and iron deficiencies and anemia (7). Deficits in macro-nutrients intakes may result in Protein-Energy Malnutrition (8).

Nutrient deficiencies in women of child bearing age negatively affects their health, fertility, function, pregnancy outcomes, survival, growth, risk of congenital disabilities and the development of their children putting both the mother and child's health at risk (9,10). These deficiencies are worsened during pregnancy when nutrient requirements increase to support maternal physiologic changes and fetal growth, and, if not addressed appropriately, can lead to poor pregnancy outcomes and increased risk of maternal and perinatal mortality. The consequence of poor maternal nutritional status is reflected in low pregnancy weight gain, high maternal morbidity and mortality. Some factors like unavailability of enough food, inequitable distribution of food within the same household, poor bioavailability of micronutrients, lack of knowledge about the importance of dietary diversity and frequent occurrence of infectious diseases exposes women to micronutrient deficiencies (1).

Dietary Diversity Score (DDS) is used as an indicator of micronutrient adequacy (11). The consumption of an appropriate combination of various foods helps to ensure nutrient adequacy Since a single food cannot provide all necessary nutrients for optimal health, DDS which measures the number of food items or food groups consumed over a reference period, can be used in the household or at an individual level, and has long been documented as a critical constituent of diet quality (12). A diverse diet has been linked with an increased consumption of some important nutrients (e.g calcium, iron, and magnesium, folate, vitamin A, vitamin D, vitamin E) in WRA, improving their nutritional status and health conditions (13-15). Evaluation of nutrient adequacy of diets of women of child bearing age will provide information on the relationship between dietary intake and nutrient status of this group of women in some nutrients such as Carbohydrate, protein, Phosphorus, iron, zinc, Fat, calcium, vitamin C, Sodium, Potassium, Magnesium in South- east Nigeria against the established FAO/WHO standard. Few studies are available in Nigeria that assessed nutrient adequacy of women of child bearing age. It is therefore necessary to fill the information gap in this area by conducting further research.

The purpose of this study was to assess the nutrient intake and nutrient adequacy of diets of women of childbearing age in South-east Nigeria using 24 hr. diet recall

Materials and methods

Study design

The study design was descriptive cross-sectional and included a four-stage random sampling technique. Three states namely Imo, Enugu, Anambra were selected from the South-east geo-political zone of Nigeria using stratified random sampling technique. There are nine senatorial zones in the three states and one local government area was selected from each of the nine senatorial zones using simple random technique. From the nine local government areas, 36 rural and 18 urban communities were randomly selected. A total of 1,200 respondents (households) were selected using systematic random sampling technique based on population density to represent rural and urban setting in a ratio of 3:1 (267:133). Nigeria is described as 75% rural (16).

Time and duration of the study

Data collection was carried out from October 2010 to April, 2011

Study population–

Women of childbearing age and their under- 5 children formed the sampling frame in the nine selected local Government Areas.

Sample size

Using the formula for cross-sectional studies (17) the minimum sample size was determined:

$$n = \frac{Z^2\ pq}{d^2}$$

Where:

n = minimum sample size when sample frame is more than 10,000.

Z = 1.96 the standard normal deviate (or confidence coefficients), which corresponds to the confidence level adopted.

d = 5% degree of accuracy desired (Tolerance error) = estimated proportion of target population to have a particular characteristic such as those estimated to accept the null hypothesis

p = the population of the target population estimated to have a particular characteristic (if there is no reasonable estimate 50% is used).

Q = 1-p (50% unaffected population).

Z = 1.96 (i.e. table of confidence coefficients for confidence levels in (18)

The estimated proportion of success (of accepting the various null hypotheses) = 50%

Therefore,

$$n = \frac{Z^2\ pq}{d^2} = \frac{1.96^2\,(0.5)(0.5)}{0.05^2}$$

$$= 384$$

The sample size (n) for the study should therefore be three hundred and eighty four (384) citizens. The sample size was increased to 400 subjects per State, for three (3) States making it a total of 1200 subjects.

Data collection

Dietary Assessment: Trained interviewers conducted a face – to- face 24-hour dietary recall on two non-consecutive days with a pre-tested questionnaire to obtain information on the subjects' food intake with an interval of two days between them including both weekdays and weekends. Subjects were asked to recall all foods and beverages taken in the previous twenty-four hours prior to the interview.

Dietary diversity Score: Dietary Diversity Score (DDS) was assessed from the information collected from the 24-hour dietary recall of the subjects, using a scale of ten food groups according to FAO guidelines for measuring Minimum Dietary Diversity for Women of childbearing Age (MDD-W) (19). For the purpose of this study, their food consumption was assessed using one 24 hr. diet recall. All food items reported to be consumed during the first 24 h recall were classified into ten food groups, according to the MDD-W (20).

The DDS described in these guidelines consist of a simple count of food groups that the individual has consumed over the preceding 24 hours (Table 1). For each respondent, a minimum of 0 and a maximum of 10 points could be obtained. MDD-W equaled 1 if the women consumed at least 5 different food groups and 0 otherwise. Higher scores would mean higher diversity because more food groups would be reported to be eaten. To achieve minimal dietary diversity, respondents must consume foods from at least five of the ten food groups.

Nutrient Adequacy: Also, twenty-four-hour dietary recall data were analysed using adapted Total Dietary Assessment (TDA) Software to get the Nutrient consumed by the women. Nutrient intake was determined using Adapted Total Dietary Assessment (TDA) software version 3 (2001) and compared to recommended nutrient intake (21). Nutrient Adequacy Ratio (NAR) was derived for energy and 11 nutrients by dividing the nutrient intake of each woman by her Recommended Dietary Allowance (RDA. The nutrient adequacy ratio for energy, fat, carbohydrate, protein, Iron, magnesium, zinc, potassium, sodium, phosphorus, calcium and vitamin C were calculated using the formula: nutrient Intake of an individual divided by recommended Dietary Allowance (RDA) for that individual (22,23). Nutrient Adequacy was classified as follows:

1. Adequate- > 80 %
2. Inadequate to Mild/moderate- <80%
3. Severe- < 60%

Anthropometric Measurements: Heights of women were measured in meters using the Standiometer. Weights were measured in Kilogram (Kg) using a sensitive weighing bathroom scale (Hana bathroom scale). Individual heights and weights were then used to calculate Body Mass Index (BMI = Weight/Height$^{2)}$. Data were reported as mean ± standard deviations (SD) for continuous variables and as frequencies (i.e., percentages) for categorical variables.

Statistical analysis

Data were analysed using Statistical Packages for Social Sciences (SPSS) version 22.0 (Armonk, New York, USA) software for descriptive and inferential statistics. Data were analysed using descriptive statistics,

Table 1. Food groups used for assessment of Minimum Dietary Diversity of Women of childbearing age.

	FOOD GROUPS	SPECIFIC FOODS
1	Grains, white roots and tubers, and plantains	All types of breads and flatbreads, stiff porridges of maize, sorghum, millet or cassava (manioc), pasta, potatoes, white-fleshed sweet potatoes, white yams, yucca and plantains
2	Pulses (beans, peas and lentils	common bean (black, kidney, pinto), broad bean (fava, field bean), chickpea (garbanzo), pigeon pea, Bambara nut cowpea, lentil and soybean/soybean products or other legume products eg Akara, Moimoi, Soymilk
3	Nuts and seeds	Common nuts grown in more temperate zones include walnut. Peanut/groundnut, cashew nut, almond, chestnut, hazelnut, pecan, pistachio.
4	Dairy	This group includes almost all liquid and solid dairy products from cows, goats, buffalo, sheep or camels. Tinned, powdered or ultra-high temperature (UHT) milk, soft and hard cheeses and yoghurt and kefir are also included. However, butter, cream and sour cream, ice cream, sweetened condensed milk and processed/packaged "yoghurt drinks" are excluded. Butter, cream and sour cream are classified with fats and oils because of their high fat content and most typical culinary uses. Ice cream and sweetened condensed milk are classified with sweets.
5	Meat, poultry and fish	All meats, organ meats, poultry and other birds and fresh and dried fish and seafood/shellfish are included
6	Eggs	includes eggs from any type of bird (domesticated poultry and wild birds) but not fish roe,
7	Dark green leafy vegetables	Commonly consumed leaves vary widely by country and region, and include many wild and foraged species, as well as the green leaves of other food crops (e.g. cassava leaves, bean leaves, pumpkin leaves, amaranth leaves and others)
8	Other vitamin A-rich fruits and vegetable	The most common vitamin A-rich fruits are ripe mango and ripe papaya; others include red palm fruit/pulp, passion fruit, apricot and several types of melon. When eaten "green" (unripe), mango and papaya are not rich in vitamin A and if consumed "green" should be classified with "Other fruits
9	Other Vegetables	This group includes legumes when the fresh/green pod is consumed (as in fresh peas, snow peas, snap peas or green beans cucumber, tomato and okra (all fruits in botanical terms) are included as "Other vegetables
10	Other Fruits	This group includes sweet white bananas and most fruits, excluding vitamin A-rich fruits.

(FAO and FHI 360, 2016)

frequency counts and percentages. The mean Dietary Diversity Score for the different States were compared using two-way Analysis of Variance (ANOVA). Analysis of variance (ANOVA) procedure was used to determine any significant differences in the dietary diversity, and BMI in the three states. The scores of Nutrient intakes and BMI in the different study locations were obtained from Total Dietary Assessment (TDA) software. The nonparametric nature of the data meant that chi-square or Fisher's exact test were used to evaluate the association between categorical variables and nutritional status; $p < 0.05$ was considered statistically significant.

Results

A total of 1200 women of childbearing age (WCA) participated in the study. Majority (96.3%) Women were married. Traders represented 41.7% of the sample. Majority of the participants (97.5%) were of Ibo ethic group. The minority group included other tribes (1.7%), Yoruba (0.5%), Hausas (0.3%). More than half of the participants (54.9%) completed secondary school; 28.6% completed tertiary institution; 4.5% completed primary school and 0.8 % had no primary education. About 58.4% were earning less than fifteen thousand Naira (#15,000.00) monthly.

Table 2 shows the family size, age, height, weight and BMI of respondents. The minimum and maximum family size was 2 and 15 people respectively. The mean age, mean height and mean weight were 28.2±5.6 years, 1.60 ±0.08, and 69.11±13.89 respectively. The mean body mass index (BMI) (±SD) for the sample was 26.8±4.8 kg/m^2. The prevalence of underweight (BMI < 18.5kg /m^2) and obesity (BMI ≥ 25kg/ m^2) were 0.8%and 60.7% respectively.

Table 2. Mean Age (years), weight (kg), height (m) and family size

Variables	Minimum	Maximum	Mean	SD
Family Size Age of respondents	2 15.00	15 50.00	5 28.22	1.77 5.58
Height of mother	1.45.00	1.88.00	1.60	0.08
Weight of mother	37.00	121.00	69.11	13.89
BMI	13.78 kg/m^2	54.00 kg/m^2	26.81	4.82

Table 3. Frequency of consumption of food groups in the three states

S/N	Food groups	Anambra	Enugu	Imo	Total
1	Grains, white roots and tubers, and plantains	371(92.8)	366(91.5)	367(91.87)	1104(92.0)
2	Pulses (beans, peas and lentils	206(51.5)	237(59.2)	203(50.8)	646(53.8)
3	Nuts and seeds	140 (35.0)	183 (45.8)	163 (40.8)	486 (40.5)
4	Dairy	222(55.5)	181(45.2)	231(57.8)	634(52.8)
5	Meat, poultry and fish	292(73.0)	281(70.2)	346(86.5)	919(76.6)
6	Eggs	22(5.5)	19(4.8)	37(9.2)	78(6.5)
7	Dark green leafy vegetables	220(55.0)	142(35.5)	301(75.2)	663(55.2)
8	Other vitamin A-rich fruits and vegetable	220 (55.0)	202 (50.8)	275 (68.8)	697 (58.1)
9	Other Vegetables	100(25.0)	123(30.8)	171(42.8)	394(32.8)
10	Other Fruits	81(20.2)	66(16.5)	69(17.2)	216(18.0)

Note: % = percentage. Calculation for each state was based on 400 subjects while that of the South-east was based on 1200 subjects. Ten food groups were used for individual dietary
Assessment (19). A frequency table and cross-tabulation were used to analyze the ten food groups

Table 3 shows that the food groups consumed by more than 50% of the respondents were Grain/tubers (92.0%), Meat/fish/poultry (76.6%), other vitamin A rich fruits and vegetables (58.1%), Dark green leafy vegetables (55.2%), Pulses (53.8%) and Dairy (52.8%). Less than 50% of the respondent reported intake of nuts and seeds (40.5%), other vegetables (32.8%). The lowest consumption was for other fruits (18.0%) and eggs (6.5%).

Table 4 shows that the dietary diversity of highest frequencies were 6 (31.5%), 5(29.9%) and 7 (20.2%). The respondents consumed foods from a range of 1–9 groups with 140 (11.7 %) of the respondents consuming from 1 to 4 food groups (i.e., non-diverse diet), 81.6% (979) consuming from 5 to 7 food groups (average), and 6.8% (81) consuming from 8 to 10 food groups (i.e., highly diverse diet).

About 1060 (88.3%) achieved minimum Dietary Diversity for Women of Childbearing Age (MDD-W) of consuming 5 or more food groups. Even though Imo MMD-W was higher (92.0%), the difference between the states was not significant (P> 0.05)

Table 5 shows that the mean dietary diversity score for South- east was 5.78±1.16. The highest dietary diversity score was recorded for subjects from Imo State (5.99 ± 1.14), followed by Enugu State (5.69±1.14) and Anambra State (5.64 ±1.18) with Imo being significantly higher (P<0.05) than Enugu and Anambra.

Table 6 shows the dietary intakes for the Nutrients of interest and **t**he percentage of women that consumed > 80% of their recommended dietary allowance (RDA) and were in adequate category were for energy 80.5%, Carbohydrate (90.2%), protein (82.0%), iron (94.6%), zinc (72.7%) and Phosphorus (51.4%), while the percentage of women that consumed < 60% of their requirement and were in severe inadequacy category were for Calcium (88.1%), Sodium (63.1%), Potassium (91.2%), Magnesium (57.6 %) and vitamin C (78.2 %%).

Table 4. Dietary Diversity Scores (DDS), Dietary diversity Terciles and Minimum Dietary Diversity for Women of Childbearing Age (MDD-W) in the three states and South-east Nigeria.

Dietary Diversity Scores	**Anambra (%)**	**Enugu (%)**	**Imo (%)**	**Total (%)**
1	0.0	0.3	0.0	0.1
2	0.5	0.0	0.5	0.3
3	2.5	1.5	1.3	1.8
4	12.3	10.0	6.3	9.5
5	31.0	34.3	24.5	29.9
6	29.8	31.0	33.8	31.5
7	18.5	16.8	25.3	20.2
8	5.5	5.8	8.3	6.5
9	0.0	0.5	0.3	0.3
Dietary diversity terciles				
Low (1-4 food groups	15.2	11.8	8.0	11.7
High (5-10 food groups)	84.8	88.2	92.0	88.4
High(8-10 food groups)	5.5	6.2	8.5	6.8
Food groups				
< 5 food groups	15.3	11.8	8.0	11.7
≥ 5 food groups	84.7	88.2	92.0	88.3
Total	100.0	100.0	100.0	100.0

Sample size for each State was 400, South- east- 1200, % = percentage. Frequency table and cross tabulation and chi-square was used to analyse the fourteen food groups and the terciles.

Table 5. Comparison between states (dietary diversity score) in the states and sector.

State	**N**	**Minimum**	**Maximum**	**Mean**	**SD**	**T**	**P-VALUE**
Anambra	400	2.00	8.00	5.64	1.18		
Enugu	400	1.00	9.00	5.69	1.14		
IMO	400	2.00	9.00	5.99	1.14	10.912	.001
Sector							
Urban	397	1	9	5.73	1.12	3.697	.055
Rural	803	2	8	5.87	1.18		
South East	1200	1.00	9.00	5.78	1.16		

N = Number, **SD= Standard deviation.** Cross tab and chi-square tests were used to analyzed the difference between states. Using one way ANOVA to compare the difference in mean of the Minimum Dietary Diversity for WCA between States in table 5, it was found that, there was significant (P= 0.001) difference among States. A t-test revealed no significant (t=3.70, p>.0.05) mean difference between sectors.

Table 6. Distribution of study subjects according to Nutrient Adequacy Ratio of Selected Nutrients.

Nutrient Adequacy Ratio(NAR)	Imo N (%)	Enugu N (%)	Anambra N (%)	South-East N (%)
Energy(kcal)				
Adequate(> 80% of requirement)	316(79.0)	304(76.0)	346(86.6)	966(80.5)
Inadequate:				
Mild /moderate (<80% of requirement)	60(15.0)	72(18.0)	40(10.0)	172(14.3)
Severe inadequacy(<60% Requirement)	24(6.0)	24(6.0)	14(3.5)	62(5.2)
Protein(g)				
Adequate (> 80% of requirement)	322(80.5)	313(78.3)	349(44.5)	984(82.0)
Inadequate:				
Mild /moderate (<80% of requirement)	55(13.8)	63(15.8)	37(9.2)	155(12.9)
Severe inadequacy(<60% Requirement)	23(5.8)	24(6.0)	14(3.5)	61(5.1)
Carbohydrate(g)				
Adequate (> 80% of requirement)	348(87.0)	360(90.0)	374(93.5)	1082(90.2)
Inadequate:				
Mild /moderate (<80% of requirement)	36(9.0)	27(6.8)	20(5.0)	83(6.9)
Severe inadequacy(<60% Requirement)	16(4.0)	13(3.2)	6(1.5)	35(2.9)
Fat(g)				
Adequate (> 80% of requirement)	147(36.8)	114(28.5)	156(39.0)	417(34.8)
Inadequate:				
Mild /moderate (<80% of requirement)	106(26.5)	134(33.5)	109(27.2)	349(29.1)
Severe inadequacy(<60% Requirement)	112(28.0)	125(31.5)	72(18.0)	309(25.8)
Calcium(mg)				
Adequate ((> 80% of requirement)	16(4.0)	13(3.2)	17(4.3)	46(3.8)
Inadequate:				
Mild /moderate (<80% of requirement)	37(9.2)	38(9.5)	22(5.5)	97(8.1)
Severe inadequacy(<60% Requirement)	347(86.8)	349(87.2)	361(90.2)	1057(88.1)
Phosphorous(mg)				
Adequate(> 80% of requirement)	206(51.5)	190(36.4)	221(55.2)	617(51.4)
Inadequate:				
Mild /moderate (<80% of requirement)	80(20.0)	77(19.2)	63(15.8)	220(18.3)
Severe inadequacy(<60% Requirement)	114(28.5)	133(33.2)	116(29.0)	363(30.2)
Sodium(mg)				
Adequate(> 80% of requirement)	104(21.3)	53(13.2)	109(27.3)	247(20.6)
Inadequate:				
Mild /moderate (<80% of requirement)	59(14.8)	64(16.0)	73(18.2)	196(16.3)
Severe inadequacy(<60% Requirement)	256(64.0)	283(70.8)	218(54.5)	757(63.1)
Potassium(mg)				
Adequate(> 80% of requirement)	25(6.2)	7(1.4)	13(3.2)	45(3.8)

Table 6 (*Continued*)

Nutrient Adequacy Ratio(NAR)	Imo N (%)	Enugu N (%)	Anambra N (%)	South-East N (%)
Inadequate:				
Mild /moderate (<80% of requirement)	24(6.0)	15(3.8)	22(5.5)	61(5.1)
Severe inadequacy(<60% Requirement)	351(87.8)	378(94.5)	365(91.2)	1094(91.2)
Zinc				
Adequate(> 80% of requirement)	247(61.8)	291(72.7)	334(83.4)	872(72.7)
Inadequate:				
Mild /moderate (<80% of requirement)	95(23.8)	73(18.2)	44(11.0)	212(17.7)
Severe inadequacy(<60% Requirement)	58(14.5)	36(9.0)	22(5.5)	116(9.7)
Iron				
Adequate (> 80% of requirement)	368(92.0)	379(94.8)	388(97.0)	1135 (94.6)
Inadequate:				
Mild /moderate (<80% of requirement)	26(6.5)	15(3.8)	10(2.5)	51(4.3)
Severe inadequacy(<60% Requirement)	6(1.5)	6(1.5)	2(0.5)	14(1.2)
Magnesium				
Adequate(> 80% of requirement)	84(21.0)	67(16.7)	87(21.7)	238(19.8)
Inadequate:				
Mild /moderate (<80% of requirement)	102(25.5)	68(17.0)	101(25.2)	271(22.6)
Severe inadequacy(<60% Requirement)	214(53.5)	265(66.2)	212(53.0)	691(57.6)
Vitamin C(mg)				
Adequate(> 80% of requirement)	79(19.7)	58(14.6)	66(16.4)	203(17.0)
Inadequate:				
Mild /moderate (<80% of requirement)	23(5.8)	23(5.8)	13(3.2)	59(4.9)
Severe inadequacy(<60% Requirement)	298(74.5)	319(79.8)	321(80.2)	938(78.2)

Discussion

This study examined the minimum Dietary Diversity of Women of Childbearing Age (MDD-W) who had under 5 children and their nutrient intake in South-east Nigeria. The mean age, mean height and mean weight were 28.2±5.6 years, 1.60 ±0.08, and 69.11±13.89 respectively. The mean body mass index (BMI) (±SD) for the sample was 26.8±4.8 kg/m^2. The prevalence of underweight (BMI < 18.5kg /m^2) and obesity (BMI ≥ 25kg/ m^2) were 0.8% and 60.7% respectively. The prevalence of underweight and obesity is in this study is in contrast to the study of (24 and 25) who reported prevalence of obesity of 24.4% and 20.9 % in their study in adult female population of Ikwo, Ebonyi State and and Umudike, Umuahia respectively but lower than the study in Abuja who reported prevalence of overweight/obesity of 74.0% (26).The burden of obesity is projected to increase in the future (27) and has been found to be a major health challenge leading to disabilities and death irrespective of the country.

The diet diversity scores (DDS) of individual subjects ranged from 1-9. The dietary diversity of highest frequencies were 6 (31.5%), 5(29.9%), 7(20.2%) and 4(9.5%). Minimum Dietary Diversity for Women of childbearing Age (MDD-W) was 88.3% and the Mean dietary diversity Score (MDDS) was 5.78±1.16 (83.28%), with rural 5.87± 1.18 and urban 5.73 ±1.12 in the South- east Nigeria. The mean dietary diversity score of 5.78±1.16 which is higher than the 5-point cut-off proposed by (19) showed that they were more likely to have consumed higher (more adequate) micronutrient. Several studies conducted in some other

countries using the same methodology had obtained lower results (28- 32). These studies reported MDDS of 4.73±1.34, 4.2 ±1.5, 4.76 ± 1.23, 3.68 ±2.10 and 3.99 ± 0.20 respectively. Also, result of this study showed that 88.3% of WCA living in South-east Nigeria had a diverse diet. This is in contrast to other studies conducted in some other countries using the same methodology who reported MMD-W of 57.7 % in the study of eight Latin American Country (28), 46.1% in Northern Ghana (29), 55.1% in Nepal (30) and 55% in Ethiopia (31). This difference might be due to geographical location and seasonal variability as the studies were not done during the same time of the year.

In this study, Grains, white roots and tubers, and plantains were the food group consumed by nearly all the population (92.0%) probably due to food habit and its low cost and high satiety value. These foods are capable of satisfying hunger at a cheaper price compared to protein sources and vegetables that are more costly and difficult to afford by respondents of low-income. This finding is Similar to the study carried out by (28) who reported that 99.4% consumed starchy foods and lower than (31) who reported starchy food intake of 64.7%. The food groups less reported by this study were nuts and seeds (40.5%), fruits (18.0%) and eggs (6.5%) and this is in agreement with the study of (30) who reported nuts and seeds intake of 3.1 % and (28) who reported intake of less than 45% for eggs, fruits, nuts and seeds.

The nutrient adequacy ratio (NAR) for a given nutrient is the ratio of a subject's intake to current recommended allowance for the subject's sex and age category (23). The nutrient adequacy ratio (NAR) of the diet of these subjects was calculated for energy and eleven other (11) nutrients. About 60% of the population studied was overweight showing they consumed more calories than what they expended in physical activities. Placing the nutrient intake on adequate/ inadequate category, it was confirmed that over 80% of the subjects had adequate intake of energy, protein, and carbohydrate. The intake of energy and protein in this study is in contrast to the study conducted by (33) on non-pregnant non lactating women who reported energy intake of 52-53% of RDA which is lower than above 80% reported in this study. Despite a higher MMD-W of intake in women with a diverse diet 88.3% some of the micronutrient intakes of these women were less than optimal especially for Magnesium, Sodium, Potassium, and Vitamin C where more than 75% of the respondents scored lower than of their RDA but adequate for Iron (94.6%), Zinc (72.7%) and Phosphorus (51.4%). Over 95 % had inadequate intake of Calcium and Potassium. This is in contrast the study conducted by (34) on women of reproductive age group in rural Varanasi India who reported iron intake of 70.48% of RDA which is lower than the finding of this study and vitamin C intake of 171.13% which is far above the findings of this study. Micro nutrients play very significant role in the physical and mental wellbeing of human population. Even though the MDD-W and the MDDS of women of Child bearing age in this study was high, the actual consumption showed inadequate consumption of some of the micro nutrients. This insufficient nutrient intake of subjects poses problems for women's health both in terms of increased risk of unfavourable maternal and birth outcomes as well as of long-term consequences related to overall health and wellbeing (35). These findings suggest that there is a significant need for establishing healthy eating patterns and improving micro nutrients intakes among all WCA.

Conclusions and recommendations

It was evident that many women in this study had low micronutrient intakes, and if continued in the longer term, these women would be at great risk of developing micronutrient deficiencies. Nutrition education aimed at improving proper nutrition, increased micro-nutrients intake among women of childbearing age is recommended in South-east Nigeria.

Acknowledgement: Our gratitude goes to the staff of the local government authorities and the communities for their support to conduct the study and to the subjects for providing the required information. We would also want to thank the field officers and their supervisors for their cooperation.

Funding: The study was self -funded.

Authors' contributions: GN carried out the data collection, data analysis and interpretation and drafted the manuscript; RA contributed to the project design, supervised and corrected the project.

All authors have read and approved the manuscript and made their contributions to improve the manuscript.

Consent for publication: Consent for publication is not necessary because this manuscript does not have personal data like individual details, images or videos.

Data and material availability: I declare that the data and material for this manuscript are available.

Ethics approval and consent to participate: Ethical clearance was given by the University of Ibadan/University College Hospital (UI/UCH) Ethics Committee, College of Medicine University of Ibadan. Permission was also obtained from the Local Government Chairmen and the community Chiefs. The purpose of the study was explained to the women who gave their consent and also dully filled the informed consent forms. Participants (women) were informed of their freedom to withdraw or refuse to take part in the study without prejudice. Some declined after explanation.

Conflict of interest: No potential conflict of interest relevant to this article was reported by the authors

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