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DIETARY DIVERSITY AND NUTRIENT INTAKE ADEQUACY AMONG WOMEN IN IWO LOCAL GOVERNMENT AREA, OSUN STATE NIGERIA

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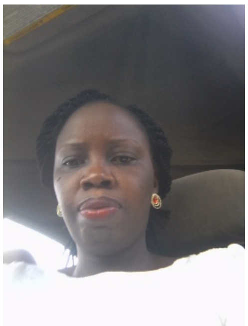

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ABSTRACT

Dietary diversity has been considered a potential 'proxy' indicator to reflect nutrient intake adequacy. The study assessed the Dietary Diversity and Nutrient Intake Adequacy among adult women in Iwo Local Government (LGA) area of Osun State. Apparently healthy 250 adult women (20-59) were the respondents in the study. The anthropometric measurements of the respondents were taken using standard equipment. A 24-hour dietary recall questionnaire was used to assess the food intake of the respondents, which was converted into nutrient intake using adapted Total Dietary Assessment (TDA) software. Dietary Diversity Score (DDS) was created using a 15-food group model. Nutrient intake was evaluated using Nutrient Adequacy Ratio (NAR). Mean adequacy ratio (MAR) was calculated as an indicator of nutrient intake adequacy. Statistical Package for Social Sciences (SPSS) software was used for analysis of the data collected. More than half (56.4%) of the respondents had normal body weight, 15.2% were underweight, 21.2% were overweight and 7.2% were obese. The diet of the respondents consisted of food items mainly from food groups such as cereals, white roots and tubers, vitamin A-rich vegetables, spices, condiments and beverages. Fruits and foods from milk and milk products were the least consumed. The mean DDS was 8.29±1.3, 4.4% of the respondents had high DDS, 94.4% had minimum DDS and 1.2% had low DDS. The MAR was 2.56±0.69, the intake of some nutrients such as carbohydrate, fat, iron, zinc and protein was above the recommended dietary intake and there was inadequate intake for some nutrients such as calcium, vitamin C and potassium among the respondents. Consumption of foods from groups such as meat and meat products, eggs and poultry and fish were found to be significantly related with nutrient intake adequacy as respondents with adequate intake of nutrients consumed more from these food groups. These results indicate that dietary diversity is an indicator of nutrient intake adequacy. Most of the respondents consumed foods from cereals, white roots and tubers, vegetables, legumes, oil and fats, spices and condiments than from other food groups.

Key words: Dietary-diversity, Nutrient, Women, Food-groups, Overweight, Micronutrient, Adequacy, Nigeria

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INTRODUCTION

Nutrient intake adequacy is referred to as the mean ratio of intake to recommended intake of energy and selected nutrients [1]. It is one of the various dimensions of indexes of dietary quality, which is increasingly used as a tool in monitoring population's adherence to dietary advice mostly in industrialized countries. Studies have shown that dietary diversity is strongly associated with nutrient intake adequacy [2].

Since there is no single food that can provide all the required nutrients necessary to achieve optimal health, the more food diversity in the daily diet the greater the likelihood of meeting nutrient requirements. Dietary diversity is defined as simple count of food items or food groups used in the household or by the individual over a reference period. Dietary diversity has been considered a potential 'proxy' indicator to reflect nutrient intake adequacy [3].

As dietary factors are associated with increased risk of chronic diseases and under nutrition, local and international dietary guidelines recommend improved diversity of the diet to reduce the incidence of chronic diseases such as cancer. Several studies have also shown that the overall nutritional quality of the diet is improved with diverse foods [4]. Therefore, diversity in the diet is important to meet the requirements for energy and other essential nutrients especially for those who are at the risk of nutritional deficiencies. Dietary diversification is one of the four main strategies advocated worldwide for improving nutritional status of a population especially in vulnerable groups such as women and children [2, 5].

The prevalence of many nutrient deficiencies varies greatly according to age, gender, physiological, pathological and socio-economic conditions, and yet women's dietary intake receives insufficient attention in many developing countries including Nigeria [3, 5]. The Minimum Dietary Diversity for Women (MDD-W) is a dichotomous indicator of whether or not women aged 15-49 years have consumed at least five out of ten defined food groups the previous day or night and the proportion of these women who reach this minimum population can be used as a proxy indicator for higher micronutrient adequacy [6].

The Women's Dietary Diversity Project (WDDP) was designed in 2005 specifically to respond to the need for generating simple yet valid indicators of women's diet quality. This collaborative research initiative used existing dietary intake data from 5 resource-poor settings to document women's diet quality, defined as micronutrient adequacy, and to test whether food group diversity indicators (FGI) could be a useful tool in large-scale nationally representative surveys to predict women's dietary quality [7]. The aim of this study was to measure dietary diversity and nutrient intake adequacy among adult women in Iwo Local Government Area, Osun State, Nigeria.

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MATERIALS AND METHODS

Sampling Technique

A cross-sectional and descriptive study design was used. This study was carried out in Iwo Local Government Area (LGA) in Osun State, Nigeria. Apparently 250 healthy adult women (20-59) were the respondents in the study.

Using a multi-stage sampling technique, three (3) wards (Gidigbo III, Oke -adan and Gidigbo I), were randomly selected from the fifteen (15) wards of Iwo Local Government Area (LGA). From each of these three (3) wards, one community was randomly selected from the list of communities in the wards and from the household list in the communities, eighty-four (84) households were selected from Adeeke in Gidigbo III, eighty-three (83) from Odeomosan in Oke-adan and eighty-three (83) from Kajola in Gidigbo I using systematic random sampling.

Data Collection

A structured questionnaire was used to collect information on the bio-data and socio-economic characteristics of the respondents. The anthropometric measurements of the respondents were taken using standard equipment such as height-to-meter for measuring the height and bathroom weighing scale for measuring the weight. A 24-hour dietary recall questionnaire [8] was administered to the respondents to obtain information on their food intake for a single day. Food intake was converted to nutrient intake using an adapted Total Dietary Assessment (TDA) software [9].

Dietary Diversity Score Categorization

Based on a 15-food group model as designed by FAO [10], Dietary Diversity Score (DDS) was created and categorized per the number of food groups consumed in the 24 hours preceding the study. Dietary Diversity Score was categorized as low DDS, which is consumption below 6 food groups, minimum DDS (6-10 food groups) and high DDS (11-15 food groups). According to Schaetzel [11], Nutrient adequacy ratio (NAR) of energy and each of the selected nutrients were computed and categorized as low intake (intake <60%), adequate intake (60% - 80%) and high intake (80% - 100%). Mean adequacy ratio (MAR) which is an overall measure of nutrient adequacy of the group was also calculated [4].

NAR = (Nutrient intake ÷ Recommended intake) × 100
MAR = ΣNAR (each truncated at 1) ÷ Number of nutrients

Statistical Analysis

The adapted Total Dietary Assessment Software (TDA) was used to convert food intake to nutrient intake. Actual nutrient intake was compared to the Recommended Dietary Allowances (RDA) [12].

Statistical Package for Social Sciences (SPSS, version 16.0) was used for data analysis. Descriptive statistics (mean, standard deviation, frequency, percentages) and inferential statistics (chi-square and correlation) were done.

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RESULTS

Bio-Data and Socio-Economic Characteristics of the Respondents

The bio-data and socio-economic characteristics of the respondents are presented in Table 1. The mean age of the respondents was 34.06±12 years and the age range was 20-59.

Nutritional Status and Dietary Diversityof the Respondents

The mean height of the respondent was 1.57±0.05m and the range was 1.49m – 1.64m. The mean weight was 56.8±11.1kg and ranged from 42.7kg to 78.9kg; As shown in Table 2, more than half (56.4%) of the respondents had normal body weight, 15.2% were underweight and 7.2% were obese.

The mean Dietary Diversity Score (DDS) was 8.29±1.3. As shown in Table 2, a larger proportion of the respondents (94.4%) had minimum DDS and 4.4% of the respondents had a high DDS.

It was observed that in the 24hr period preceding the study, all respondents (100%) consumed food items from the spices, condiments and beverage groups; 98.8% from the oil and fat group, 98% from the cereal group, 83.6% from vitamin A-rich vegetable group and 98.4% from other vegetable groups. Only 10% of the respondents consumed food items from the milk and milk product group and 0.4% from the vitamin A-rich fruits group.

Nutrient Intake Adequacy

Table 3 shows the estimated mean intake and adequacy of energy and selected nutrients among the respondents. The estimated Mean Adequacy Ratio (MAR) of energy and 11 nutrients of this study population was 2.56±0.69. The table also shows that 96.0%, 93.6%, 80.0%, 71.6% and 52.8% of the respondents had their estimated intake above the RDA (excess intake) for some nutrients such as iron, fat, zinc, protein, and carbohydrate, respectively. However, 99.6%, 98.4%, 95.2%, 79.2% and 75.2% of the respondents had their estimated intake below the RDA (inadequate intake) for some other nutrients such as potassium, calcium, vitamin C, sodium and magnesium, respectively.

Nutrient Intake Adequacy and Dietary Diversity

As shown in Table 4, there was a significant relationship between the Nutrient Adequacy Ratio (NAR) of all the participants and their Dietary Diversity Score (p=0.012). The higher the adequacy of nutrient intake, the higher the dietary diversity score.

Table 5 shows that the dietary diversity score did not significantly affect the nutritional status of the respondents (P = 0.372). Out of the 38 respondents that were underweight, 36 (94.7%) of them had minimum DDS and 2 (5.3%) had high DDS. None had low DDS.

Socio-economic variables, Nutritional status and Dietary Diversity

It was observed that marital status and the monthly income of the respondents were factors that significantly affected the nutritional status of the respondents (P=0.001, P=0.001, respectively). However, the level of education, occupation and the family

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structure did not significantly affect the nutritional status of the respondents (P= 0.521, P=0.062, P=0.141, respectively).

It was also observed that there was no significant relationship between the DDS and ethnicity (P = 0.087), religion (P = 0.673), family structure (P = 0.462), marital status (P = 0.389), occupation (P = 0.458), educational level (P = 0.150) and monthly income (P = 0.632) of the respondents. However, a significant association was observed between age and DDS. (P= 0.013).

Table 6 shows that there was a significant association between nutrient intake adequacy of the respondents and their consumption of food from food groups such as meat and meat products (P = 0.003), fish (P = 0.006), eggs and poultry (P = 0.003) as respondents with adequate and excess intake of nutrients consumed more from these food groups. There was, however, no significant relationship between the Nutrient Intake Adequacy and consumption of foods from food groups such as cereals (P = 0.597), fats and oil (P = 0.278), legumes (P = 0.588), white roots and tubers (P = 0.396), vitamin A-rich vegetables (P = 0.784), nuts and seeds (P = 0.141), vitamin A-rich fruits (P = 0.533), milk and milk products (P = 0.420), sweets (P = 0.164), spices, condiments and beverages.

DISCUSSION

In this study, larger proportions of the respondents were Yorubas and this is because the study was carried out in a Yoruba-speaking community. Over half of the respondents were Muslims and it has been reported that "Iwo has a higher population of Muslims than Christians" [13]. Iwo is a rural area, hence majority of the respondents were traders and few of them were civil servants.

It was observed that there is a coexistence of overweight/obesity and underweight among the study population and this is referred to as double burden of malnutrition, which has been reported to be a common challenge in most developing countries including Nigeria [14].

Underweight among the respondents is of public health importance. Low body weight has been linked to greater mortality risk and underweight individuals do not usually have enough nutritional reserve to mobilize in time of illness [15]. Factors such as inadequate food intake, poor nutritional quality of diets, frequent infections, and short inter-pregnancy intervals have been reported as the most frequent causes of maternal under nutrition [16].

The diet of the respondents consisted mostly of cereals, spices, condiments and beverages, vegetables, oils and fats, white roots and tubers. Spices are beneficial to health if used in the right quantity but may result in harmful effect if used in excess. They can modify the nutritional value of the food thereby causing changes in the food itself [17]. Foods from the cereal group were also highly consumed among the respondents. It has been reported that dietary fibre from cereals, rather than fruits or vegetables, appears to

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be more protective against the development of several chronic diseases, including metabolic syndrome and cardiovascular disease [18, 19].

Approximately 1.7million deaths worldwide are attributable to low consumption of fruits and vegetables [20]. Low consumption of fruits and vegetables is among the top ten risk factors selected for global mortality. Worldwide, insufficient consumption of fruits and vegetables is estimated to cause around 14% of gastrointestinal cancer deaths, about 11% of ischemia heart disease deaths and about 9% of stroke deaths [21].

The mean DDS (8.29) obtained in this study was higher than the mean DDS reported by previous studies in developing countries. A mean DDS of 6.17 was reported in Pakistan, 5.81 reported in Nigeria and a mean DDS of 4.02 reported in South Africa [3, 22, 23]. In a study conducted among food aid users in France, it was reported that maternal factors such as age, marital status, educational level, parity and gestational age were factors that influenced Dietary Diversity. The same study reported that low educational level and unemployment were associated with consumption of unhealthy diets [24]. A study among women in an urban area in Burkina Faso also revealed that DDS was not associated with socio-economic characteristics of the women using a nine (9) food group classification but those using a twenty-two (22) food group classification, and that a significantly higher DDS was reported among the younger women, those with higher income and with at least a minimum education [25]. This study, however, used a fifteen-food group classification and showed that women less than 35 years, had a significantly higher DDS than the older ones. A similar finding has been reported in Pakistan [22].

In a study among adults 20-60 years in India, age, monthly income and marital status showed significant effect on overweight and obesity [26]. In another study in Turkey, age, educational level and marital status were factors that were found to affect Body Mass Index (BMI) [27]. Similar results were obtained in this study as marital status and monthly income were found to significantly affect BMI.

From previous studies, the reference value for Mean Adequacy Ratio (MAR) for an adequate nutrient intake is 1.00 [2, 4]. The MAR of the respondents is 2.56 and it has been stated that the group mean intake of most nutrients must exceed the reference values in order to achieve an acceptably low prevalence of inadequate nutrient intake [5]. This is an indication that the nutrient intake of the respondents is adequate, which might be the result of variation in the diet of the study population. Studies have shown that a diverse diet is a proxy for nutrient intake adequacy [2, 4, 28].

The results show that intakes of some nutrients such as carbohydrate, fat, iron, zinc and protein were above the RDA. It has been reported that the risk of chronic diseases such as obesity, cardiovascular disease, type 2 diabetes, osteoporosis, and sarcopenia can be reduced by moderately higher intakes of dietary protein greater than the RDA [20, 29]. High fat diets have been reported to stimulate voluntary energy intake due to their high-energy density [31]. Through studies on general population, individuals who consume diets high in fat particularly saturated fat have shown increased risk of diabetes and heart diseases, while mixed diets with high animal protein content have been found to increase the risk of kidney problems and some types of cancer [32, 33, 34].

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Intakes of some of the nutrients such as sodium, potassium, calcium, phosphorus, vitamin C and magnesium were below the RDA among the respondents with similar findings being reported in South Africa [5]. This might have occurred due to low consumption of fruits as well as milk and milk products, eggs and poultry among the respondents. Dairy products (milk, yogurt and cheese), fruits, eggs and poultry are rich dietary sources of potassium, magnesium, calcium and phosphorus [35, 36].

The effect of calcium deficiency on health cannot be underestimated especially among women. It has been reported that estimated calcium consumption was significantly low in osteoporotic patients than in a group of control subjects matched according to age and sex. This finding was reported after a study was carried out on 166 osteoporotic individuals to evaluate the suggestion that calcium deficiency may lead to osteoporosis [37].

Vitamin C has been identified as one of the nutrients identified to play a critical role in the normal functioning of the skin, particularly when nutrient deficiencies are apparent [38]. In the study that directly related dietary intakes of vitamin C with skin aging, lower intakes of vitamin C were significantly related to the prevalence of a wrinkled appearance and senile dryness, independent of age, sun exposure, race, menopausal status, energy intake, education, family income, Body Mass Index, supplement use, and physical activity [38].

Judging that the respondents in the study are women of reproductive age and the importance of these aforementioned nutrients, the study provides an important finding that supports the need for interventions that will improve the consumption levels of micronutrients among women. Dietary diversity was associated with nutrient intake adequacy (P=0.012) of the respondents.

This study observed a significant relationship between consumption of foods from food groups such as meat and meat products (P = 0.01), eggs and poultry (P = 0.003), fish (P = 0.006) and nutrient intake adequacy of the respondents. This shows that women who consume foods from these groups also had adequate intake for all nutrients. It has been reported that animal source foods can provide a variety of micronutrients that are hardly obtained from plant source foods alone in adequate quantities [39].

CONCLUSION

The study concludes that dietary diversity is a useful indicator of nutrient intake adequacy. Majority of the respondents had minimum dietary diversity score. More respondents consumed foods from cereals, white roots and tubers, vegetables, legumes, oil and fats, spices and condiments than from other food group twenty-four (24) hours preceding the study. Majority of the respondents had their estimated nutrient intake adequacy for macronutrients, iron and zinc above the RDA, while they had an estimated nutrient intake adequacy for other micronutrients below RDA. This study also concludes that consumption of meat and meat products, fish, eggs and poultry contributed to the nutrient intake adequacy of the respondents.

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Table 1: Bio-data and Socio-Economic Characteristics of the Respondents

Variable	Frequencies (N)	Percentages (%)
Tribe		
Yoruba	226	90.4
Igbo	19	7.6
Hausa	5	2.0
Religion		
Christianity	113	45.2
Islam	137	54.8
Family Structure		
Monogamous	179	71.6
Polygamous	71	28.4
Marital Status		
Single	88	35.2
Married	137	54.8
Widowed	25	10
Occupation		
Student	55	22
Trader	97	38.8
Civil Servant	26	10.4
Artisan	37	14.8
Unemployed	15	6.0
Others	20	8.0
Educational Level		
No Formal Education	35	14.0
Primary School Completed	14	5.6
Secondary School Not Completed	19	7.6
Secondary School Completed	113	45.2
Diplomas	54	21.6
Degree	15	6.0
Monthly Income		
No Income	88	35.2
$11- $32	97	38.8
$33 - $55	13	5.2
$56 - $76	44	17.6
$77 - $98	5	2.0
>$99	3	1.2

$1 = ₦450

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Table 2: Nutritional Status and Dietary Diversity Score (DDS) of the Respondents

Variable	Frequencies	Percentages
Nutritional Status		
Underweight	38	15.2
Normal Weight	141	56.4
Overweight	53	21.2
Obese	18	7.2
Total	250	100
Dietary Diversity Score (DDS)		
Low DDS	3	1.2
Minimum DDS	236	94.4
High DDS	11	4.4

Table 3: Estimated Mean Nutrient Intake and Intake Adequacy of the Respondents

Nutrients	RDA	Mean ± SD	Inadequate	Adequate	Excess
			N (%)	N (%)	N (%)
Calorie (kcal)	2000	1627 ± 784	83 (33.2)	71 (28.4)	96 (38.4)
Protein (g)	46	56 ± 84	36 (14.4)	35 (14.0)	179 (71.6)
Carbohydrate (g)	275	270 ± 148	48 (19.2)	70 (28.0)	132 (52.8)
Fat (g)	10	31 ± 17	9 (3.6)	7 (2.8)	234 (93.6)
Vitamin C (mg)	75	9 ± 20	238 (95.2)	7(2.8)	5 (2.0)
Calcium (mg)	1100	186 ± 159	246 (98.4)	3 (1.2)	1(0.4)
Phosphorus (mg)	700	568 ±408	115 (46.0)	34 (13.6)	101 (40.4)
Sodium (mg)	1900	617 ± 647	198 (79.2)	27 (10.8)	25 (10.0)
Potassium (mg)	4700	762 ± 579	249 (99.6)	-----------	1 (0.4)
Zinc (mg)	8	17 ±81	22 (8.8)	28 (11.2)	200 (80.0)
Iron (mg)	8	27 ± 24	5 (2.0)	5 (2.0)	240 (96.0)
Magnesium (mg)	315	152 ± 107	188 (75.2)	22 (8.8)	40 (16.0)

RDA- Recommended Dietary Allowance

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Table 4: Dietary Diversity Score (DDS) and Nutrient Adequacy Ratio (NAR)

DDS	Inadequate Intake n (%)	Adequate Intake n (%)	Excess Intake n (%)	Total n	P-value
Low DDS	2 (66.7%)	0 (0.0)	1 (33.3%)	3	
Minimum DDS	28 (11.9%)	48(20.3%)	160 (67.8)	236	
High DDS	0 (0%)	1 (9.1%)	10 (90.9%)	11	
Total	30 (12.0)	49 (19.6)	171 (68.8)	250 (100%)	0.012

Table 5: Dietary Diversity Score (DDS) and Nutritional Status of the respondents

BMI	Low DDS n (%)	Minimum DDS n (%)	High DDS n (%)	Total n (%)	P-value
Underweight	0 (0.0%)	36(94.7%)	2 (5.3%)	38	
Normal	2 (14%)	131(92.9%)	8 (5.7%)	141	
Overweight	1 (1.9%)	502 (98.1%)	0 (0.0%)	53	
Obesity type 1	0 (0.0%)	15 (93.8%)	1 (6.3%)	16	
Obesity type 2	0 (0.0%)	1 (100%)	0 (0.0%)	1	
Morbid obesity	0 (0.0%)	1(100%)	0 (0.0%)	1	
Total	3 (1.2%)	236(94.4%)	11 (4.4%)	250 (100)	0.372

BMI- Body Mass Index

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Table 6: Food Groups Consumed and Nutrient Adequacy Ratio (NAR)

Food groups	Inadequate intake n (%)	Adequate Intake n (%)	Excess Intake n (%)	Total n (%)	P-value
Cereals	29 (11.8%)	48 (19.6%)	168 (68.6%)	245(98.0)	0.597
White roots & Tubers	17 (19.1%)	43 (23.1%)	126 (67.7%)	186(74.4)	0.346
Vitamin A-Rich Vegetables	23 (11.0%)	44 (21.1%)	142 (67.9%)	209(83.6)	0.784
Other vegetables	30 (12.2%)	49 (19.9%)	167 (67.9%)	246(98.4)	0.209
Other fruits	2 (4.8%)	7 (16.7%)	33 (78.6%)	42 (16.8)	0.777
Vitamin A-rich fruits	0 (0.0%)	0 (0.0%)	1 (100.0%)	1(0.4)	0.533
Meat & meat Products	6 (5.8%)	19 (18.4%)	78 (75.7%)	103(41.2)	0.010
Eggs & Poultry	4 (5.9%)	7 (10.3%)	57 (83.8%)	68(27.2)	0.003
Fish	8 (6.1%)	26 (19.8%)	97 (74.0%)	131(52.4)	0.006
Legumes	22 (12.5%)	30 (17%)	124 (70.5%)	176(70.4)	0.588
Nuts & Seeds	3 (4.5%)	16 (23.9%)	48 (71.6%)	67(26.8)	0.141
Milk & Milk Products	3 (11.1%)	3 (11.1%)	21 (77.8%)	27(10.8)	0.420
Oils & Fats	30 (12.1%)	49 (19.8%)	168 (68%)	247(98.8)	0.278
Sweets	2 (3.6%)	14 (25.0%)	40 (71.4%)	56(22.4)	0.164
Spices, Condiments & Beverages	30 (12.0%)	49 (19.6%)	171(68.4%)	250 (100)	-----------

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