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Micronutrient Dietary Diversity among Female Students in Akwa Ibom State University

Udoh, E. S.

Department of Agricultural Economics and Extension,
Akwa Ibom State University Obio Akpa Campus, P.M.B 1167, Uyo, Nigeria
Corresponding Author's email address: ekaette.udoh@gmail.com

Abstract
Generally, the study assessed the micronutrient dietary diversity among female students in Akwa Ibom State University, Nigeria. A proportionate sampling procedure was used to select 186 respondents. Data were collected with the aid of a well-structured questionnaire and analysed descriptively. Majority of respondents are in the age group, 21-25 (63.44%); single (91.40%) and live in campus environs (61.29%). Micronutrient food sources most and least consumed, respectively, within the 7-day recall period are palm oil (97.85%), a source of vitamin A; and liver (39.78%), a source of zinc. The percentage prevalence shows that slightly over half (50.54%) of the population are micronutrient dietary diverse. The mean margin reports a gap of one micronutrient food source between the micronutrient non dietary diverse and micronutrient diversity line. Additionally, the disaggregated mean prevalence indicates an exact gap of three (3) micronutrient food sources between the micronutrient non dietary diverse and the micronutrient dietary diverse. Intensity implies that the micronutrient dietary diversity gap is more critical when the mean *mddi* is adopted as critical index than when two-thirds of the mean of this index is used. The study suggests awareness programmes that create an incentive to increase micronutrient dietary diversity, be mounted by government and non-governmental organizations, to bridge the gap between the micronutrient non dietary diverse and the micronutrient dietary diverse; specifically emphasizing liver, a source of zinc; sweet potatoes, a source of vitamin A; carrots and mangoes, sources of vitamin A.

Keywords: prevalence, margin, intensity, dietary diversity, micronutrient

Introduction

Studies that border on the subject of dietary diversity and related issues continue to retain relevance owing to the fact that such research is pivotal in fulfilling a critical part of the crucial United Nations sustainable development goals. The specific goal that would benefit most from a study in this vein include the aim of 'zero hunger'; the particular targets that provide the basis for this study are to reduce hunger, ensure access by all people to safe, nutritious and sufficient food and reduce all forms of malnutrition (Otekunrin *et al*., 2022; UNGA 2015; EUPHA 2017). Dietary diversity is a broadly accepted proxy of diet quality which encompasses the three pillars of food security - availability, accessibility, utilization (Parapputharu *et al*., 2015; Pal *et al*., 2017). Dietary diversity is accepted to mean the sum of varied food groups eaten within a stated pocket of time. The frame of consideration has been known to vary and is usually restricted to the preceding day or 7-day time bloc. (FAO, 2011; WFP, 2010). Empirical literature has established that dietary diversity score is a valid proxy measure of micronutrient adequacy of diets of women of reproductive age (Herforth *et al*., 2016a, b). Ideal micronutrient status is significant for the health of women, especially those of reproductive age. A woman's health and nutritional status during these years, therefore, has crucial implications for pregnancy and child birth health outcomes later in life (Chong *et al*, 2020). Accordingly, deficiencies in critical micronutrients, such as iron, zinc and Vitamin A, are recognized factors of contrary health and pregnancy outcomes, including anemia and a gamut of other birth defects (Hanson *et al*., 2015; Stephenson *et al*., 2018; Cetin *et al*., 2019). Women are susceptible to micronutrient deficiencies as a result of inadequate dietary intake, want of availability of food, unbalanced distribution of food within the same household and frequent occurrence of infectious diseases (Darnton-Hill *et al*., 2012). The most common micronutrient deficiencies in women are iron, vitamin A and zinc (Mutthayya *et al*., 2013).

A review of extant literature reveals that several studies on the subject of dietary diversity have been carried out

on the global frontier; in low and middle income countries (Mayen *et al*., 2014); among women of reproductive age in Kyrgyzstan (Otunchieva *et al*., 2022) and women in rural Bangladesh (Harris-Fry *et al*., 2015). Additionally, on the world view, studies have been done among preschoolers and rural households in China (Gao *et al*., 2022; Tian *et al*., 2022), among adults in Brazil (Bezerra and Sichieri, 2011) and among women and adolescents in Iran (Nachvak *et al*., 2017; Vakili *et al*., 2013). Reportedly, on the global scene, studies have also been carried out among women in farm households in India (Viswanthan *et al*., 2015), village level studies in Eastern India (Parapputharu *et al*., 2015) and among women of reproductive age in Kolkata (Pal *et al*., 2017). Similarly, studies on the subject have been done in varying parts of Africa such as: among rural households and adults in South Africa (Taruvinga *et al*., 2013; Labadarios *et al*., 2011) among adult refugees in Algeria (Morseth *et al*., 2017), pregnant women in Ghana (Saaka *et al*., 2021), rural households in Cambodia (MacDonald *et al*., 2015) and among rural women in Kenya (Ngala, 2015). Further literature review reported studies among households in rural Tanzania (Mbwana *et al*., 2016); mother-child pairs and adolescent girls in Ethopia (Bosha *et al*., 2019; Birru *et al*., 2018) women in Mali (Kennedy *et al*., 2009) and Burkina Faso (Savy *et al*., 2006; Custodio *et al*., 2015).

Generally, in the Nigerian context (Ajani 2010; Ayenew *et al*., 2018; Obayelu and Osho, 2020; Mekonnen *et al*., 2021) conducted research on dietary diversity. Specifically, in Nigeria; among school aged children and adolescents, in the South-West and North (Adeomi *et al*., 2022); among women and children under five in the South-west (Oladoyinbo *et al*., 2017; Otekunrin *et al*., 2022); among women of reproductive age in South-East (Onyeji and Sanusi, 2020). Furthermore, in Nigeria, studies have been done among street food consumers in South West (Leshi and Leshi, 2017); among households in the North-Central (Agada and Igbokwe, 2015; Muhammad-Lawal *et al*., 2017) and undergraduates in South-West (Sedodo *et al*., 2014). Other contemporary studies related to micronutrient dietary diversity, within the Nigerian parlance, focused on: energy and nutrient intakes of rural school children in relation to dietary diversity (Ayogu, 2019); nutrient intake of children 4-13 years (Tassy *et al*., 2021) and food sources of key nutrients among children 4-13 years (Sanusi *et al*., 2022). Some of the recent studies in the South East of Nigeria; specifically among female undergraduates (Udoh and Offor, 2020) and household food preparers (Udoh and Udoh 2019) provide more detail, such as the gap in number of food groups consumed between the different categories of dietary diversity, in describing the dietary diversity of the given populations by applying three measures namely: prevalence, margin and intensity. This study, however, takes it a step further; while applying these three measures, it zeroes in on the micronutrient dietary diversity (embracing food groups selected food groups of named micronutrients) of women of reproductive age, instead of the proxy dietary diversity, of female students in a public university in Akwa Ibom State.

Methodology

Study Area

Akwa Ibom State University is a multi-campus institution with 2 campuses located in the central and southern parts of the state. The main campus is in Mkpat-Enin L.G.A, but also including parts of Eastern obolo, Onna and Ibeno Local Government Area (LGA). The faculties of Pysical and applied sciences, Engineering, Education are in the main campus. The Obio-Akpa campus is the second site where the faculties of Agriculture, social science and management science and faculty of Art are situated. This campus has a sub-urban setting, adjoining Abak town and is within a 30-minute drive from Uyo.

Data Collection

The population of the study comprises the total number of female students in Akwa Ibom State University in the 2019/2020 academic year which stood at 9728 accounting to information contained in Akwa Ibom State Annual report 2015-2019. The total number of AKSU population = 9728. The sample size was obtained as follows, using Cochran's formula:

$$n = \frac{XN}{(X+N-1)}$$

Where, N= population number

$$X = \frac{Z^2_{a/2} * P * (1-p)}{MOOE^2}$$

Where, $Z^2_{a/2}$ = critical value of the normal distribution at a/2 (e.g. for a confidence interval of 95%; a is 0.05 and the critical value is 1.96), $MOOE^2$ = Margin of error; 5% (0.05), P = Sample proportion; 50% (0.5), N = Population size; N for AKSU = 9728.

First, we solve for x by substituting for

$Z^2_{a/2}$, P, $(1-p)$ and MOE^2 follows:

$$X = \frac{1.96^2 * 0.5 * 0.5}{(0.05)2}$$

$$= \frac{0.9604}{0.0025}$$

$$= 384.16$$

Recommended sample size for AKSU is, hence, obtained by simply substituting for x and N

$$\text{Sample size (n)} = \frac{9728 * 384.16}{(384.16+9728-1)}$$

$$= \frac{3,735,552}{10,111}$$

$$= 370$$

From the formula, the recommended sample sizes for AKSU is 370'. The value was obtained with a margin of error (5%), confidence interval (95%) and a sample proportion of 50%. Assuming half of the population is female; the recommended sample size is therefore 185, which is 370/2.

To obtain this sample size, equal opportunity of being sampled was given to each faculty. The sample size of 185 was proportionately drawn as shown in Table 1.

Analytical Framework: Prevalence, Margin and Intensity

The framework of estimation follows Udoh and Udoh (2020) who obtain the prevalence, margin and intensity of dietary diversity of households in Akwa Ibom State. This study slightly modifies their method or restricting the basis of categorizing households into dietary diverse and non-dietary diverse to two critical indices, the mean and two-thirds of the mean and also by obtaining a micronutrient dietary diversity index rather than a regular dietary diversity index.

Micronutrient Dietary Diversity Index: This was obtained by expressing the number of micronutrient foods sources a respondent reports to have consumed within the recall period as a function of the total number (11) of the micronutrient (Vitamin A, Iron and zinc) food sources presented (Table 3). It was, therefore, a figure that lies between 0 and 1; $^{1}/_{11}$, $^{2}/_{11}$.....$^{11}/_{11}$

Dietary diverse and Non-Dietary Diverse (Threshold Scores): Two threshold scores, namely; the mean dietary diversity score and two thirds of the mean dietary diversity score are used to categorise female students into dietary diverse and non- dietary diverse. This is done such that students with values below the threshold scores are said to be non- dietary- diverse and students with value equal and above the threshold scores are said to be exactly dietary diverse (dietary diversity line) and dietary diverse respectively .

***Prevalence*:** Two measures of prevalence are applied and are reported in this study.

***Percentage prevalence*:** Is simply a percentage of female students who fall below (are not micronutrient dietary diverse) and above / equal to (are dietary diverse) the critical scores. This measure uses an indicator function that takes on a value of 1 for students who are not micronutrient dietary diverse (and those who dietary diverse), alternately and expresses it as a proportion of the total number of female students. Further multiplying the values by 100 gives the final outcome – percentage prevalence. This is obtained as seen in equations 1 and 2, where the mean is used as critical index; and equations 3 and 4 where two-thirds of the mean is used as critical index:

$$mddi_{pp} = \sum_{i=1}^{N} 1(mddi < \overline{mddi})\frac{1}{N} \dots\dots.1$$

$$mddi_{pp} = \sum_{i=1}^{N} 1(mddi \geq \overline{mddi})\frac{1}{N} \dots\dots.2$$

$$mddi_{pp} = \sum_{i=1}^{N} 1(mddi < {}^{2}/_{3}\,\overline{mddi})\frac{1}{N} \dots\dots 3$$

$$mddi_{pp} = \sum_{i=1}^{N} 1(mddi \geq {}^{2}/_{3}\,\overline{mddi})\frac{1}{N} \dots\dots 4$$

Where $mddi_{pp}$ = percentage prevalence of micronutrient dietary diversity,

N = total number of female students.

***Disaggregated mean prevalence*:** This is essentially a mean computed based on actual values of *mddi* (as opposed to the use of an indicator function that assigns 1 to students who are not micronutrient dietary diverse). It measures the precise gap, by implication, between the micronutrient dietary diverse and the micronutrient non dietary diverse. Multiplying this mean measure by the total number of food groups gives the number of food groups consumed by the specified categories.

This measure is obtained as following with equation pairs 5, 6 and 7, 8 adopting the mean and two thirds of the mean as critical indices respectively:

$$mddi_{pa} = \sum_{i=1}^{N} (mddi < \overline{mddi})\frac{1}{n} \dots..5$$

n = number of female students with $mddi < \overline{mddi}$.

$$mddi_{pa} = \sum_{i=1}^{N} (mddi \geq \overline{mddi})\frac{1}{n} \dots\dots 6$$

n = number of female students with $mddi \geq mddi$

Using 2/3 mean as critical index:

$$mddi_{pa} = \sum_{i=1}^{N} (mddi < {}^{2}/_{3}\,\overline{mddi})\frac{1}{n} \dots\dots 7$$

n = number of female students with $ddi < {}^{2}/_{3}\,mddi$

$$mddi_{pa} = \sum_{i=1}^{N} (mddi \geq {}^{2}/_{3}\,\overline{mddi})\frac{1}{n} \dots\dots 8$$

n = number of female students with $mddi \geq {}^{2}/_{3}\,\overline{mddi}$.

$mddi_{pa}$ = disaggregated mean prevalence of micronutrient dietary diversity.

***Mean Margin*:** This is basically a deviation from the threshold score by female students who are not micronutrient dietary diverse. The mean margin measures the mean difference between students who are exactly micronutrient dietary diverse and those who are not. It is obtained given in equations 9 and 10, using the mean and two thirds of the mean as critical indices, respectively:

$$mddi_{mm} = \sum_{i=1}^{N} \overline{mddi} - < \overline{mddi})\frac{1}{n} \dots\dots 9$$

n = number of female students with $mddi < \overline{mddi}$

$$mddi_{mm} = \sum_{i=1}^{N} {}^{2}/_{3}\,\overline{mddi} - < {}^{2}/_{3}\,\overline{mddi})\frac{1}{n} \dots\dots.10$$

n = number of female students with $mddi < {}^{2}/_{3}\,\overline{mddi}$

$mddi_{mm}$ =mean margin of micronutrient dietary diversity

***Intensity*:** This is the mean margin squared. It measures how critical, the deviation from the margin is, with a higher value suggesting a more critical case. Using the mean and two thirds of the mean, respectively, it is obtained as given in equations 11 and 12.

$$ddi_{imm} = \sum_{i=1}^{N} (\overline{ddi} - < \overline{ddi}) \frac{1}{n})^2 \ldots\ldots 11$$

n = number of female students with $ddi < \overline{ddi}$

$$ddi_{imm} = \sum_{i=1}^{N} ({}^2/_3\,\overline{ddi} - < {}^2/_3\,\overline{ddi})^2 \frac{1}{n} \ldots..12$$

n = number of female students with $ddi < {}^2/_3\,\overline{ddi}$

$mddi_{mm}$= intensity of the mean margin of micronutrient dietary diversity.

Results and Discussion

Frequency distribution of personal characteristics of female students

Results of the frequency distribution of age, marital status, residence and year of study of students are reported in Table 2. The study (Table 2) reports that majority of the female students in Akwa Ibom State University are in the age group, 21-25 (63.44%); single (91.40%) and live in campus environs (61.29%).

Specific micronutrient food sources consumed during 7-day recall period

Table 3 is a multiple response table consisting of a non-repetitive list of selected sources of vitamin A, iron and zinc. There are, embedded in this list, six, six and five sources, respectively, of vitamin A, iron and zinc. The sources of Vitamin A are: carrots and mangoes, palm oil, sweet potatoes, dairy, red meat and eggs. The sources of Iron are: red meat, leafy vegetables, legumes, liver, fish and nuts. The sources of zinc are: red meat, legumes, dairy, eggs and nuts. Micronutrient food sources most and least consumed (Table 3), respectively; within the 7-day recall period are palm oil (97.85%), a source of vitamin A; and liver, a source of zinc. Results (Table 3) indicate that more than 80% of the population consumed the following micronutrient food sources within the recall period: legumes (81.72%), a source of iron and zinc; vegetables (83.87%), a source of iron and nuts (88.17%); a source of iron and zinc. A range including half to three quarters of the population, as seen in Table 3, reportedly consumed sweet potatoes (51.61%) a source of vitamin A; carrots and mangoes, a source of vitamin A; and red meat, a source of vitamin A, iron and zinc. These findings are plausible because the diets of the Akwa Ibom people typically consists of cassava staples (*gari* and *fufu*) usually served with soups which have the main ingredients as vegetables, palm oils; the protein sources in these meals run the gamut from sea foods to red meat, depending on the preferences and purchasing power of the consumer. Legumes are also popular among the people especially a derived product of beans-bean cake known as *akara.* Groundnuts are an everyday snack of the people; particularly fried usually eaten with biscuits, bread, soaked gari, e.t.c. This outcome implies that at least four out of five students consumed a minimum of one source each of Vitamin A, iron and zinc. Related findings, Udoh and Offor (2020) indicate that more than seven out of ten of female students in public universities in Akwa Ibom State consume legumes (78.5%), vitamin A rich vegetables (74%), thus corroborating the results of this study. In a similar vein and in tandem with the results of this study, Udoh and Udoh (2019), report that more than 70% of female household food preparers consumed: beef (86.65%), legumes (82.78%), dairy (82.93%) and vegetables (95.62%). The results of this study are further corroborated by Mbwana *et al*., (2016), in a study of household dietary practices in rural Tanzania, who reported that 72% of respondents consumed vitamin-A with other vegetables. Additionally, Oladoyinbo *et al*., (2017), assessing women in a South Western state in Nigeria, report that respondents consume, in consonance with this study, 83.6% from vitamin A-rich vegetable group and 98.4% from other vegetable groups, while in contrast, 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. This concord possibly takes the bearing from the fact that similar outcomes are expected, specifically from women of child bearing age (Udoh and Offor, 2020); and women in general (Mbwana *et al*., 2016; Oladoyinbo *et al*., 2017; Udoh and Udoh, 2019). On the contrary, Harris-Fry *et al* (2015) report differing figures, from those obtained in this study, for the consumption of legumes and nuts (34%), eggs (20%), vitamin A rich vegetables and fruits (20%), organ meat (3%) and dairy (33%). In additional contrast, Onyeji and Sanusi (2020) found that women of reproductive age in three South Eastern states in Nigeria; a broader and likely more varied population spectrum than this study, consumed Vitamin A rich vegetables (47.6%), organ meat (1.8%), beef (58.2%), eggs (6.5%), legumes and nuts (53.8%), dairy (52.8%). Otunchieva *et al*., (2022), in a study among women of reproductive age in a low-income setting, report similar figures for the consumption of vitamin A rich fruits (>80%), dairy (> 75%) but differing ones for nuts and seeds, legumes, eggs (> 30%). Furthermore, Gao *et al*., (2022), analysing pre-schoolers in rural areas, report contrary values for dairy (60.1%), legumes, nuts and seeds (< 30%) and relatively similar ones for Vitamin-A rich fruits and vegetables (71.3%). This marked difference is plausibly associated with the fact that; whereas this study was conducted among female students in a public University, the contrasting outcomes (Onyeji and Sanusi, 2020; Harris-Fry *et al.,* 2015; Otunchieva *et al*., 2022 and Gao *et al*., 2022) were obtained over a varied population, in rural areas and low-income settings, respectively, usually associated with low diversity in diets.

Prevalence of micronutrient dietary diversity in the Study Area

Table 4 presents the percentage prevalence in proportions. This table also reports the disaggregated mean prevalence, the respective means of the two

named categories of female students. Table 4, indicates that a little over half (50.54%) and the whole population (98.92%) are micronutrient dietary diverse, considering the mean and two thirds of the mean, respectively, as critical indices. The disaggregated mean prevalence, Table 4, given two thirds of the mean as critical index, shows that the micronutrient non dietary diverse and the micronutrient dietary diverse, respectively, consume six (0.5226) and nine (0.7793), out of the eleven (11) micronutrient food sources. This implies that there is a gap of three micronutrient food sources between the two groups of respondents. Similarly, considering the mean as critical index, the ***mndd*** and the ***mdd*** consume seven (0.6576) and ten (0.8929) micronutrient food sources. This, therefore, implies a gap of three micronutrient food sources between these two defined categories of the population.

In concord with this study, Udoh and Offor (2020), in a similar study among female students in public universities in Akwa Ibom State, found that non dietary diverse and dietary diverse female students consume five (5) and nine (9) food groups respectively. In additional tandem with the results of this study, Schwei *et al* 2017 report that one third of respondents consume five, six and seven food groups respectively. In further consonance with this study, Gao *et al*., (2022) report a dietary diversity of at least five out of eight food groups by just about half of the population (49.8%). Some authors (Oladoyinbo *et al*., 2017; Saaka *et al*., 2021; Onyeji and Sanusi 2020; Otunchieva *et al*., 2022; Muhammad-Lawal *et al*., 2017;Sedodo *et al*., 2014) report a mean dietary diversity of, eight out of fifteen food groups, at least five out of 10 food groups; 7.0 out of 14 food groups, four to six out of twelve food groups, five out of eight respectively, which is akin to the disaggregated mean prevalence, taking two thirds of the mean as critical index, which indicates that the micronutrient non dietary diverse consume six out of eleven micronutrient food sources. These corroborating outcomes with respect to the micronutrient non dietary diverse are plausibly due to the attendant fact that irrespective of the population- households (Muhammad-Lawal *et al*., 2017) or women, specifically (Oladoyinbo *et al*., 2017); pregnant (Saaka *et al*., 2021), women of reproductive age (Onyeji and Sanusi 2020; Otunchieva *et al*., 2022) and /or undergraduates (Sedodo *et al*.,2014; Udoh and Offor, 2020); some level of dietary diversity is usually achieved, whether acceptable or unacceptable. Ayenew *et al*. (2018) reported a mean dietary diversity of 6.4 and 6.6, during planting and harvesting seasons respectively, from a nine (9) food group poll; this corroborates the findings of this study, which indicates that the micronutrient dietary diverse consume nine out of eleven micronutrient food sources. This observed consonance may owe to the fact that studies involved a more embracing population In a related vein, Taruvinga *et al*. (2013), analysed rural household dietary diversity in South Africa, reported medium dietary diversity, that is, a range of (4-6) out of 12 food groups within the 24-hour recall period which is in tandem with the number of micronutrient food sources reportedly consumed by the micronutrient non dietary diverse in this study. The stated consonance with the micronutrient non dietary diverse may not be unrelated to the fact that the study was conducted in the rural area where dietary diversity scores are in more cases than others expected to be relatively low. In contrast to the reported outcomes of this study, however, other studies (Harris-Fry *et al*; McDonald *et al*. 2015; Agada and Igbokwe, 2015) report mean dietary diversity scores of 3.8, 4.7 and 4.6, respectively.

Mean margin and intensity of micronutrient dietary diversity of female students in Akwa Ibom State University

Based on two critical indices, the mean micronutrient dietary diversity index (0.78) and two-thirds of the mean micronutrient dietary diversity index (0.52); Table 5 shows the mean margin and the intensity of micronutrient dietary diversity of respondents. The mean margin, considering the mean as critical index (0.1264) implies a gap of one (1) micronutrient food source between the micronutrient non dietary diverse and the exactly micronutrient dietary diverse (micronutrient dietary diverse line). This means that, in practical terms, it requires the consumption of one extra micronutrient food source to bring the population to a place where it is exactly micronutrient dietary diverse. The intensity (0.1110), in this vein, suggests that gap here is not very critical. On the other hand, the mean margin, given two thirds of the mean as critical index, takes on a value, zero, because there is no respondent with an *mddi* value less than this critical index; the intensity in this instance is also zero for the same reason. Udoh and Offor, who similarly described dietary diversity of female students in public universities in Akwa Ibom state report a gap of one food groups between the non-dietary diverse and the dietary diversity line. Udoh and Udoh (2020), in a study of households in Akwa Ibom State, in contrast with the figures reported in this study, found a gap of two food groups, irrespective of the three critical indices employed, between the non-dietary diverse and the exactly dietary diverse. Mean dietary diversity terciles of 2.90, 4.53 and 6.37 are reported by Agada and Igbokwe (2015) for low, medium and high dietary diversity respectively, thus in additional opposition to the results of this study, implying a gap of two food groups between the low and medium dietary diverse. Leshi and Leshi (2017), in further contrast, found that 40%, 50% and 10% of their study population had low (<0.3), medium (≥ 0.3-0.5) and high (≥0.5-1) dietary diversity indices; these outcomes, in a similar vein, imply a gap of a minimum of two (2) food groups between the low and medium diversity cadre and a margin of a minimum of (3) food groups between the low and high dietary diversity food groups. The wider implied gaps between the dietary diverse and non-dietary diverse, relative to this study, suggest that the dietary diversity of the study population is fairly higher. This is plausible because a highly educated urban population is more likely to have a higher dietary

diversity than a population with mixed urban and rural characteristics. With respect to intensity, Udoh and Udoh (2019) report an intensity of the margin of dietary diversity (0.12) of households suggesting a gap similarly critical as in this study. In a similar vein, Udoh and Offor (2020), found an intensity of 0.04, suggesting a far less critical gap than the one reported in this study.

Conclusion

The study assessed the micronutrient dietary diversity of female students in Akwa Ibom State University. It found that the micronutrient dietary diverse and the micronutrient non dietary diverse, who constitute a little over half and about half of the respondents, respectively, consume about seven and ten micronutrient food groups. This gives interesting insight into the study population by revealing that the micronutrient non dietary diverse and the micronutrient dietary dietary diverse consume more than half of the eleven (11) selected micronutrient food sources. The female students, based on this outcome, can be seen as having high dietary diversity. It, furthermore, indicates a precise gap of three micronutrient food groups, between the micronutrient dietary diverse and the micronutrient non dietary diverse. This suggests that, technically, it would require the consumption of three food groups to move the micronutrient non dietary diverse respondents to the micronutrient dietary diverse category. The study further concludes a gap of one micronutrient food source, between the micronutrient non dietary diverse and the micronutrient dietary diverse line, implying that respondents need to consume just one extra micronutrient food source to ensure that the whole population is on the micronutrient dietary diversity line. In a further vein, the study concludes that the severity of the information gap as the intensity of the margin as being more critical when the mean is adopted as critical index. This, therefore, puts forward that it would be more apt to apply the mean as critical index in further related studies, as this provides a more incisive basis for splitting the population into micronutrient dietary diverse and micronutrient non dietary diverse.

It can be concluded that the study provides a wide gamut of detail by increasing the vista of parameters used in describing the micronutrient dietary diversity of female students in Akwa Ibom State University following the use of prevalence, margin and intensity; and also zeroing in on specific micronutrient dietary diversity. This is a definite addition to the measurement of dietary diversity in broad and specific terms and is similarly applicable to similar and varied phenomena. The study recommends that the established gap of three food sources, between the micronutrient dietary diverse and the micronutrient non dietary diverse, be bridged. This can be done by governmental and non-governmental organizations. Specifically, the gap could be closed by mounting programmes aimed at getting female students to increase the frequency of consumption of the least three frequently consumed micronutrient food groups-liver, sweet potatoes, carrots and mangoes.

Table 1: Breakdown of Proportionate sampling of respondents

Faculties	Total	Proportion sample
Arts	1320	26
Agriculture	983	18
Education	1027	20
Engineering	1873	36
Social Sciences	952	18
Physical/Applied Sciences	2313	44
Management Sciences	1260	24
Total	**9728**	**186**

Source: Field Survey, 2021

Table 2: Frequency distribution of personal characteristics of students

Variables	Frequency (N=186)	Percentage
Age		
16 – 20	56	30.11
21 – 25	118	63.44
26 – 30	12	6.45
Marital Status		
Single	170	91.40
Married	16	8.60
Residence		
Off campus	72	38.71
Campus environs	114	61.29
Year of Study		
100	32	17.20
200	42	22.58
300	24	12.90
400	54	29.03
500	34	18.28

Source: Field Survey, 2021

Table 3: Frequency distribution of micronutrient food sources consumed during 7-day recall period

S/No.	Micronutrient food sources	*Frequency	Percentage
1	Carrots and Mangoes	114	61.29
2	Palm oil	182	97.85
3	Sweet potatoes	96	51.61
4	Eggs	174	93.55
5	Red meat e.g. beef	138	74.19
6	Vegetables e.g. pumpkin	156	83.87
7	Liver	74	39.78
8	Fish	180	96.77
9	Nuts e.g. groundnut	164	88.17
10	Dairy e.g. milk, yoghurt	174	93.55
11	Legumes e.g. iron beans, honey beans, etc.	152	81.72

Source: Field Survey, 2021. *multiple response

Table 4: Prevalence of micronutrient dietary diversity in the Study Area

Critical Indices	Percentage prevalence		Disaggregated mean prevalence	
	*mndd	*mdd	mndd	mdd
0.78	0.4946	0.5054	0.6576	0.8929
0.52	0.0108	0.9892	0.5226	0.7793

Source: Field Survey, 2021 mndd: micronutrient non dietary diverse; mdd: micronutrient dietary diverse Percentage prevalence

Table 5: Mean margin and intensity of micronutrient dietary diversity of female students in Akwa Ibom State University

Critical indices	Margin	Intensity
0.78	0.1264	0.1110
0.52	0.0000	0.0000

Source: Field Survey, 2021

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