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DIETARY DIVERSITY AND SELECTED MICRONUTRIENTS STATUS OF PRIMARY SCHOOL PUPILS IN MAKURDI LOCAL GOVERNMENT AREA OF BENUE STATE

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ABSTRACT

Dietary diversity is influenced by accessibility to food, the more food groups included in a daily diet, the greater the likelihood of meeting nutrient requirements. Hence, the study was conducted to investigate the association between dietary diversity scores (DDS) and the nutritional status of 388 preschool children in Makurdi, Benue state, Nigeria. A 24 hour dietary recall questionnaires and dietary diversity scores (DDS) were calculated based on 7 food groups (starchy staples, leafy vegetables, Vitamin A rich fruits and vegetables, other fruits and vegetables, meat and fish, eggs, legumes and seeds/nuts, milk and milk products). The results revealed cereals and cereal products (51.0%) are mostly consumed daily, followed by roots and tubers (19.5%). The consumption of fruits and vegetables was low with 6.3% of the pupils consuming fruits daily and 10.9% consuming vegetables daily. This highlights potential gaps in the consumption of essential food groups contributing to dietary diversity, hence, this study reinforce the importance of continued nutrition education of mothers, caregivers and preschool staff on the need to ensure consumption of diverse food sources in order to improve the nutritional status of children. Further studies are recommended on factors associated with low dietary diversity among preschool children.

Keywords: Dietary Diversity, Nutritional Status, Primary Pupils, Makurdi, Benue State

INTRODUCTION

Dietary diversity is an essential aspect of food security which focuses not just on access to food but also the variety and quality of diets within households (Clapp *et al*., 2022; Nicholson *et al*., 2020). Globally, the importance of dietary diversity in addressing nutritional needs and promoting overall health is increasingly been recognized (Bhandari *et al.*, 2016). The significance of dietary diversity is emphasized by the Sustainable Development Goals (SDGs) of the United Nations, especially SDG 2 (Zero hunger) and SDG 3 (Good health and well-being), which emphasize the need to improve nutrition and achieve food security for all by 2030 (UNICEF, 2015).

The consumption of diverse food sources is vital for healthy growth, functional immune system and a productive life. Food is essential as it provides important nutrients for survival and helps the body function optimally (Black et al., 2013; Opoola, *et al.*, 2016). The World Health Organization (WHO) recommends a minimum dietary diversity of at least four food groups out of seven to maintain proper child growth and development (Modjadi *et al*., 2020). Consuming different food items over a reference period of time is a critical component of high quality nutrition and a reliable indicator of dietary adequacy (Okafor, *et al*., 2020).

Dietary diversity is influenced by accessibility to food, Labadarios *etal*. (2011) noted that, the more food groups included in a daily diet, the greater the likelihood of meeting nutrient requirements. It is estimated that close to one billion children in the world suffer from hunger and food insecurity, defined as not having enough calories to live a healthy life (IFPRI, 2011). Nearly the entire undernourished pupils are in developing countries with worst scenarios in Asia (578 million) and sub-Saharan Africa (239 million) (Hunger Notes, 2011). The number of people with poor access to nutritious foods rich in essential micronutrients such as fruits and vegetables, meat, fish, dairy products and bio-fortified staple foods is staggering (FAO, 2011). In the case of Nigeria, an estimated 61 percent of children suffer from obvious and hidden hunger (Momodu *et al*., 2011). This leads to deficiencies in micronutrients such as vitamin A, iron and zinc which affects the survival, health, development and wellbeing of billions of people.

The primary school-age, usually 6-12 years is an active phase for both physical growth and mental development (Soto and Tackett, 2015); and heralds an important developmental period for accumulating knowledge and learning to understand the society (Patsa and Mukherjee, 2021). Igbokwe *et al*. (2017) stated that school age children constitute about 23% of the total population of Nigeria. Consequently, proper nutrition during this period is very vital as it provides the foundation for optimum health, strength, cognitive development and productivity (Kamath *et al*., 2017). It has been reported that many children especially those from developing countries still struggle to have adequate nutrition (Asmare, *et al*., 2018; Khamis, *et al*., 2019) as most of the foods consumed in developing countries consist of monotonous starchy staples, and include little or no animal protein and few fruits and vegetables (Modjadi *et al*., 2020). As a result, the prevalence of malnutrition may be higher than reported data due to increasing tendency of the populace to consume fast and convenience foods coupled with rising prices of food due to insecurity, climate change, poor agricultural yields and global economic downturns (Owusu, 2013).

Micronutrients are needed in the body in tiny amount, but it is essential to meet physical and mental growth, specifically for producing enzymes, hormones and other biomarkers (Ritchie and Roser, 2017). Micronutrient deficiencies are still significant global health problem and WHO predicts that more than 2 billion people suffer from these deficiencies (Ritchie and Roser, 2017). WHO has highlighted upon the prevalence of both zinc and iron in Nigeria, and has estimated that the highest incidence is among children (WHO, 2013). School-aged pupils are one of the risk groups to experience micronutrient deficiencies in developing and transition economic countries (Best *et al.*, 2010). Among school aged

pupils, micronutrient deficiencies have been associated with an increased risk of lower school achievement (WHO, 2013). Others have linked poor school achievements among many primary school and adolescent children to iron deficiency (Lozoff *et al*., 2013). For girls, this is even more crucial because regular menstrual flow may start with its associated blood loss and can predispose girls to anemia. If this continues until adulthood then, there are consequences for poor pregnancy outcome and maternal mortality. Also, they are robbed of their mental as well as physical potential. Malnourished children who live past childhood, face chronic illness and disabilities often in societies with little economic capacity for even minimal therapeutic and rehabilitative measures which is strongly associated with shorter height, less schooling and reduced economic productivity (Victora *et al.,* 2021).

In Nigeria, micronutrient deficiencies are considered a great problem that is augmented by poor dieting and infectious diseases such as parasitic worms especially those affecting intestine, creating a complex cycle in children which is difficult to control due to their rapid growth rate and needs (Mrimi *et al.,* 2022). Inappropriate ingestion of these nutrients, as well as hindering its adequate absorption is augmented by illnesses and infections with various parasites eventually leading to shortage of valuable trace elements (UNICEF, 2012). For adequate development and growth, children need vital micronutrients, the most common of which are vitamin A, zinc and iron which are needed for maintaining a healthy child with intact immunity as they participate in a lot of enzymatic and biological processes (WHO, 2022).

However, this research work is meant to find lasting solution to the problems of dietary diversity and micronutrient malnutrition of school-age pupils in Makurdi LGA, so that the pupils can reach their growth potential and develop into healthy adults.

Dietary diversity in Nigeria is a significant public health concern, with studies indicating that many Nigerians particularly those in rural areas and low-income households consume limited varieties of food. This lack of dietary diversity can lead to micronutrient deficiencies and food insecurity, hence a diverse diet provides a balance of essential nutrients necessary for growth, development and overall health (Modjadi *et al*., 2020).

The diversity of the human diet is influenced by several factors, such as economic factors: e.g. cost of food items, income of family members and availability of food items. Biological factors such as hunger, appetite and taste. Physical factors such as cooking skills, access to food, time. Social factors such as family, peers and meal pattern. Health factors such as intestinal parasite and physiological determinants such as mood, stress, guilt, attitudes, beliefs and knowledge about food (WHO, 2011). This may point to the fact that, these factors are responsible for many health problems among school-age pupils as manifested in diarrhea, anemia, worm infestation and obesity, thus leading to stunting, wasting and overweight. These conditions affects the pupil's minds, bodies, academic achievements and the economic prospects of nations (Victora *et al.,* 2021).

However, information on dietary diversity and micronutrient status of school-age pupils has not been extensively examined in North Central Nigeria generally, and Benue State in particular hence the motivating factor to undertake this study. The outcomes of this study could be used to guide the federal and state governments when formulating new approaches and interventions to address dietary access and micronutrient needs of pupils in Benue State.

The study was designed to assess the dietary intake, diversity and its influence on selected micronutrients status of primary school pupils in Makurdi L.G.A of Benue State.

MATERIALS AND METHODS

Research Design

Quasi-experimental design was used for the study. It is a research design that is used when it is not ethical to carry out a randomized controlled study. It also aims to evaluate the cause, effect and relationship between variables.

Area of the Study

The study was carried out in Makurdi Local Government Area of Benue State. Makurdi is the State Capital of Benue State which is bounded in the North by Guma Local Government Area, in the West by Gwer-West Local Government Area, in the East, by Gwer-East Local Government Area

Makurdi Local Government Area is located in the River Benue valley on Latitude 7.74 degree North (7.74ºN) and Longitude 8.51 degree East (8.51ºE) with a 1004M elevation above the sea level (most complex maps for all cities in the world 2011). The Local Government Area covers a total land mass of 3,993.3 square kilometer and a projected population growth rate of 3.81% (NPC, 2023). The major tribes found in the town/local government comprises the Tiv, Idoma, Igede, Hausa and others such as Jukun, Ibos, Yoruba etc.

The town is divided by the River Benue to form two major parts which are called North Bank and South Bank that are connected by the two (2) bridges. The economic activities of Makurdi Local Government Area include farming, fishing and trading (NIPOST, 2014).

Population of the Study

The population of the study comprises of 310 registered primary schools from 11 council wards of Makurdi LGA with a total enrolment figure of 193,498 pupils (BSMOE, 2019). The primary schools consist of 72 government owned, 197 private owned and 41 mission owned.

Sample and Sampling Technique

The RaoSoft sampling technique was used for the study. It is an appropriate sampling method that researchers use to ensure that sample representation of the total population and results are reliable and generalizable. It also helps researchers determine the appropriate number of participants needed for a study based on desired accuracy levels and margin of error. The sample size of 388 pupils was arrived at using the parameters below:

Confidence level: 95%
Margin of error: 5%
Response distribution: 50%
Population size: 193,498

Furthermore, for easy and even enumeration of pupils per school, the total sample size of 388 pupils was divided by a cluster of 50 schools. Thereby, 8 pupils were randomly selected per school to partake in the study.

Instrument of Data Collection

A 24 hours Diet Recall Questionnaire made up of four (4) sections (A – D) was used to collect data for the study.

Section A: Socio Demographic data, Section B: Dietary intake and diversity. The questionnaire contained both open and closed-ended questions.

Validation of the Instrument
The instrument for data collection was validated for content and face value by three (3) specialists (Nutritionist, Medical Laboratory Scientist and a Statistician).

Method of Data Collection
Prior to the start of the research work, permission was sought from Benue State Ministry of Education and the State Universal Basic Education Board (SUBEB) to conduct research using primary school pupils in Makurdi LGA. Furthermore, permission was also sought from Benue State Ministry of Health (Ethics Committee) for the field and laboratory work. A consent letter was sent to parents/guardians for approval and participation of their child/ward in the research, giving a detailed explanation on the objectives, procedures and benefit of the research. The parents/guardians were asked to fill the consent form attached to the letter of introduction and a local witness to cross sign the consent form. Participation of their wards in the research was voluntary.

Variable Specification/Model Specification
Dietary Intake and Diversity Score Determination
The information collected from the 24hour dietary recall questionnaire was used to calculate DDS of each pupil. The study made use of 7 food-group aggregation of food groups created. The aggregated 7 food groups (starchy staples, leafy vegetables, Vitamin A rich fruits and vegetables, other fruits and vegetables, meat and fish, eggs, legumes and seeds/nuts, milk and milk products) was then used to compute the diversity score with each food group carrying a score. Pupils with a score less than 3 were regarded as having low dietary diversity, those with scores of 4 and 5 were regarded as having medium dietary diversity while those with a score of 6 and above were regarded as having high dietary diversity (Weininger, *et al.,* 2023).

Data Analysis Techniques
Data collected was analyzed with the aid of a Nutri survey application Version (2022) using descriptive statistics of frequency, simple percentages, mean and standard deviation. Chi-square was also used to find the relationship between the variables at 95% ($p \leq 0.05$) significant level using the Statistical Package for Social Sciences (SPSS V23 software).

RESULTS AND DISCUSSION
Socio-Demographic Variables of Primary School Pupils in Makurdi LGA of Benue State
Table 1 provides an overview of the demographic characteristics of Primary school pupils in Makurdi LGA. These variables include the frequency and percentage of the pupils in different Council Wards, gender, age category, class of respondent, occupation of the household head (HH), household size and average number of children in the home. The frequency and percentage of pupils in each Council ward are also provided in the table.
The total sample size for the study was 388. Fidi Council Ward had the highest percentage population of pupils with (12.9 %), followed by Central South Mission (12.6 %), Ankpa-wadata Ward had 12.4 % while the least Council Ward was Mbalagh with 2.1 %. The study consisted of 50.5 % males and 49.5 % females. Age category of 8-10 years had higher percentage of pupils with (38.7 %) followed by age category of 5-7 years (35.6 %), age category of > 11 years had the least percentage of (25.8 %). 21.6 % of the respondents were in primary 1, 16.5 % of the respondents were in primary 2, 15.7% of the respondents were in primary 3, 14.2 % of the respondents were in primary 4, 14.7 % were in primary 5 and 17.3 % in primary 6.
The occupation of household heads, artisan had a higher percentage of (22.4 %) followed by traders and civil servants (20.9 %), the least was retirees with a population of (5.7 %). The percentage population of household size was <5 (57.7%) and ≥5 (42.3%) with 4.51% as the average number of children in a household.
Findings from this study revealed differences in proportion of the socio-demographic/household characteristic of participants across the 11 Council Wards in Makurdi LGA of Benue State

Table 1: Demographic Variables of Primary School Pupils in Makurdi LGA

Variable	Frequency	Percentage
Council Wards		
Agan	24	6.2
Ankpa-Wadata	48	12.4
Bar	40	10.3
central south mission	49	12.6
Fidi	50	12.9
Market Clark	40	10.3
Mbalagh	8	2.1
Modern Market	40	10.3
North Bank 1	24	6.2
North bank 2	24	6.2
Wailomayo	41	10.6
Gender	196	50.5
Male	192	49.5
Female		
Age category		
5-7	138	35.6
8-10	150	38.7
>11	100	25.8
Class of Respondent (in Primary of class)		
1	84	21.6

2	64	16.5	
3	61	15.7	
4	55	14.2	
5	57	14.7	
6	67	17.3	
Occupation of HH			
farmer	37	9.5	
civil servant	81	20.9	
Teacher	40	10.3	
artisan	87	22.4	
trader	81	20.9	
others	40	10.3	
retiree	22	5.7	
HH size			
<5	224	57.7	
≥5	164	42.3	
Average Number of Children in the home	**Mode**	**Median**	**Standard deviation**
4.51	4.00	4.00	1.985

*Others include: Banker, Business man, Doctor, Lawyer, Nurse, Police Officer, Politician and Soldier

Dietary Intake and Diversity of Primary School Pupils in Makurdi LGA of Benue State

The dietary intake and diversity of the pupils was evaluated by food groups consumption, food consumption patterns and individual dietary diversity score (IDDS). The findings are presented in figures 4a to 4h and tables 4a to 4c.

Percentage Consumption of Food Groups by Primary School Pupils in Makurdi LGA

The percentage consumption of various food groups by the respondents is presented in Figure 1 with starchy staples having a 100% consumption level while the consumption of other food groups ranged from Dark green vegetables having 47.94%, vitamin A rich fruits and vegetables 38.92%, other fruits and vegetables 86.08%, eggs 32.99%, meat and fish 83.25%, legumes, nuts/seeds 44.07% and Milk/ milk products 46.65%.

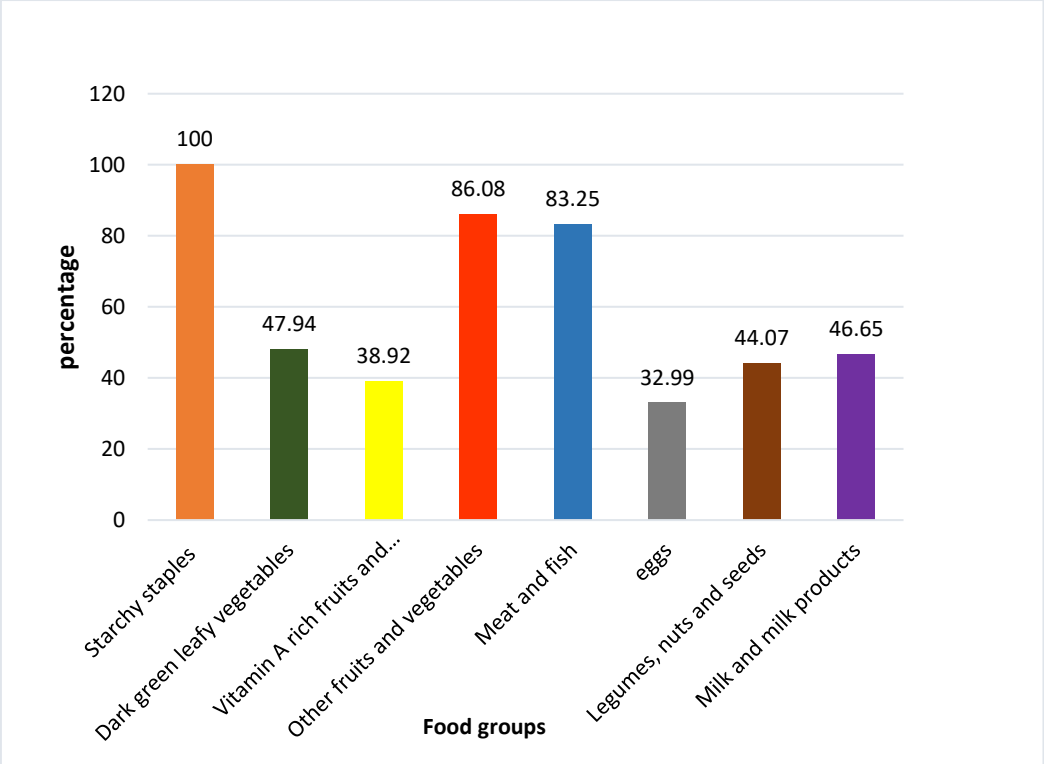

Figure 1: Percentage Consumption of Various Food Groups by Primary School Pupils in Makurdi LGA of Benue State

Food Consumption Pattern among Primary School Pupils in Makurdi LGA

Figure 2 presents the food consumption pattern of primary school pupils in Makurdi LGA. The percentage consumption of various food groups by the respondents was categorised into a frequency proceeding of daily consumption, two times a week, three times a week, four to six times a week, once a week and never. The food groups consists of cereals and cereal products, roots and tubers, milk and milk products, meat, fish, eggs, nuts and legumes, fruits and vegetables. The results revealed that cereals and cereal products (51.0%) are mostly consumed daily, followed by roots and tubers (19.5%). The consumption of fruits and vegetables was low with 6.3% of the pupils consuming fruits daily and 10.9% consuming vegetables daily.

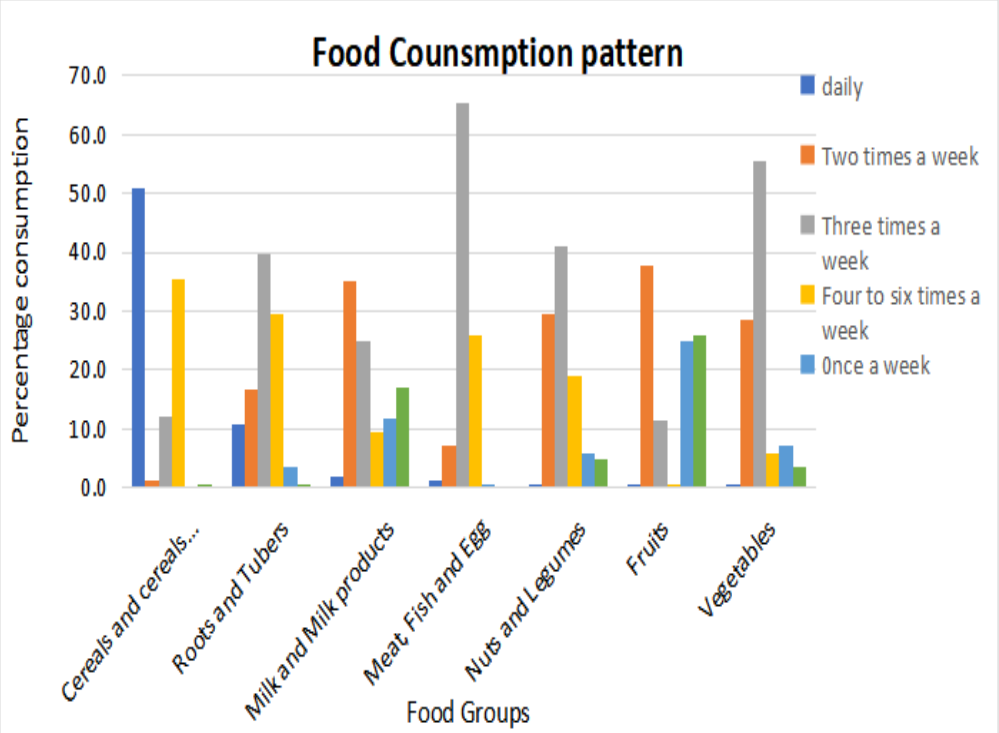

Figure 2: Food Consumption Pattern of Primary School Pupils in Makurd LGA of Benue State

Individual Dietary Diversity Score of Primary School Pupils in Makurdi LGA

Figure 3 presents the individual dietary diversity score of the pupils. The percentage of pupils with different dietary diversity scores. The x-axis shows the dietary diversity score, ranging from 0 to 8, while the y-axis shows the percentage of pupils with each score. The result shows that, the largest 39.69% of the pupils had a middling IDD score of 5, with subsequent percentage decrease from the median followed by 27.06% and 21.13%, who had a score of 4 and 6 respectively.

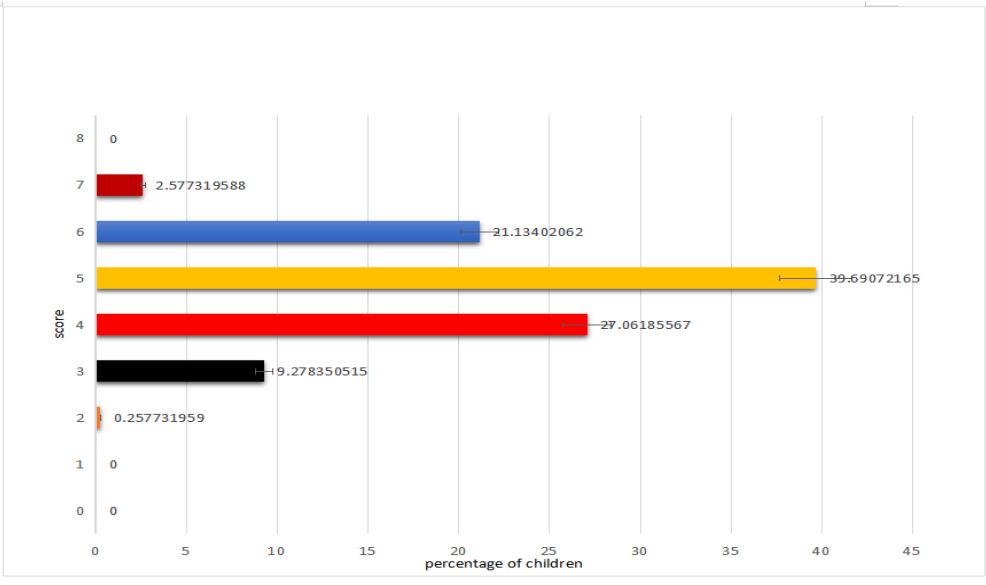

Figure 3: Individual Dietary Diversity Score of Primary School Pupils in Makurdi LGA of Benue State

Individual Dietary Diversity Score by Sex of Primary School Pupils in Makurdi LGA

Figure 4 shows the IDDS by sex categorization. There was a similar trend between the boys and girls, with 2.6% each of the boys and girls respectively having an IDDS of 7, whilst 23.5% (boys) and 18.8% (girls) had IDDS of 6 respectively. Similarly, 41.8% (boys) and 37.5% (girls) scored 5. A score of 4 was achieved by 21.4% (boys) and 32.8% (girls).

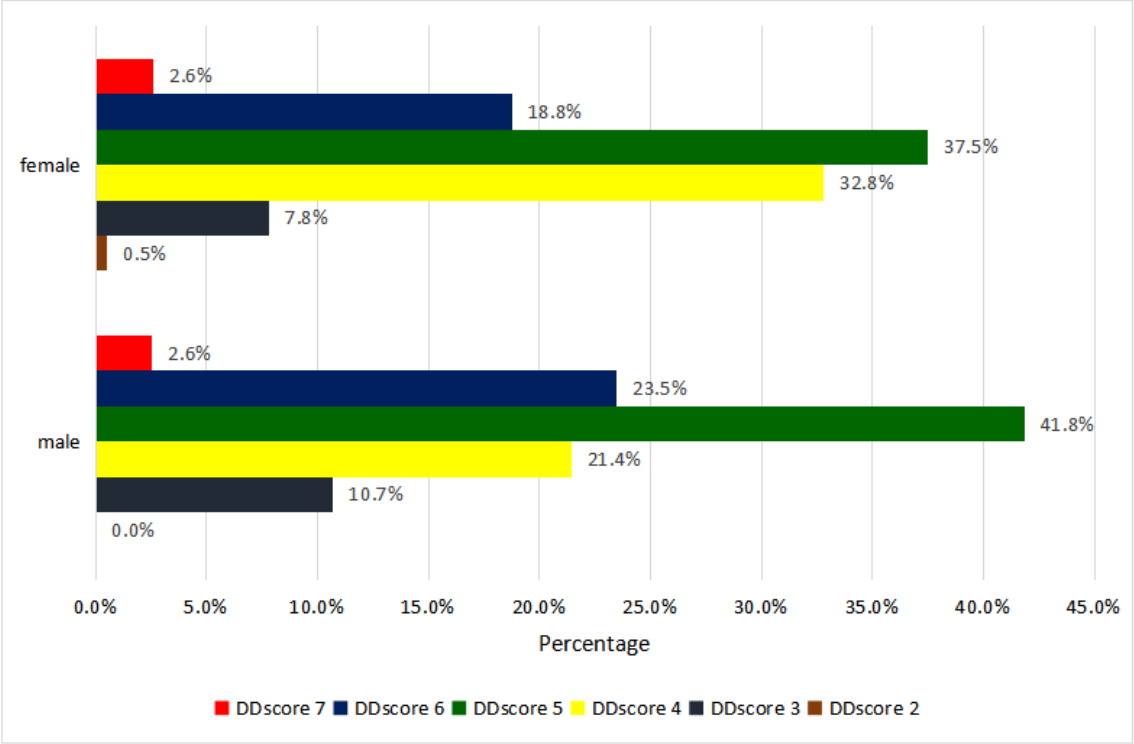

Figure 4: Individual Dietary Diversity Score by Sex of Primary School Pupils in Makurdi LGA of Benue State

Individual Dietary Diversity Score by Age Category of Primary School pupils in Makurdi LGA

Figure 5 shows the percentage of pupils and their individual dietary diversity score by age category. The figure presents the percentage of the pupils in three age categories (5-7, 8-10, and >11) with different dietary diversity scores. Specifically, 38.4% of pupils aged 5-7, 43.3% aged 8-10, and 326.0% of pupils aged >11 had IDD scores of 5 respectively. A score of 6 was achieved by a percentage of pupils aged 5-7 (21.0%), 8-10 (21.3%) and >11 (21.0%). While a score of 4 was achieved by percentages for all three age categories ranging from 23.2 % to 33.0 % across the age categories respectively.

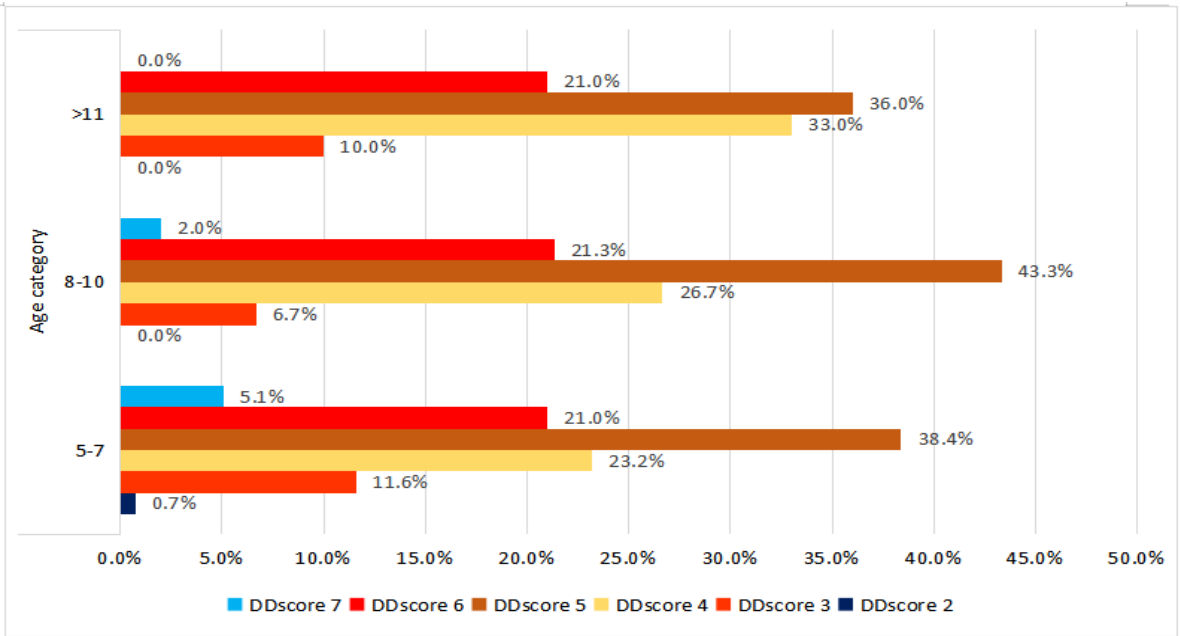

Figure 5: Individual Dietary Diversity Score by Age Category of Primary School Pupils in Makurdi LGA of Benue State

Classification of Individual Dietary Diversity Score of Primary School Pupils in Makurdi LGA

Figure 6 shows the classification of dietary diversity of the study group. 90.46% of the study group had good dietary diversity (IDDS≥4), while 9.54% had poor diversity (IDDS<4). This indicates that many pupils in the study group had a high individual dietary diversity score. Similarly, Figure 7 describes the dietary diversity classification by gender; most boys and girls had good dietary diversity scores. Specifically, 86.54% of boys and 94.27% of girls had good dietary diversity scores. The dietary diversity classification by age category as presented in Figure 8 shows that 31.19% of pupils aged 5-7 years had good dietary diversity, while 36.08% of pupils aged 8-10 years and 23.23% of 11 years and above also had good dietary diversity respectively.

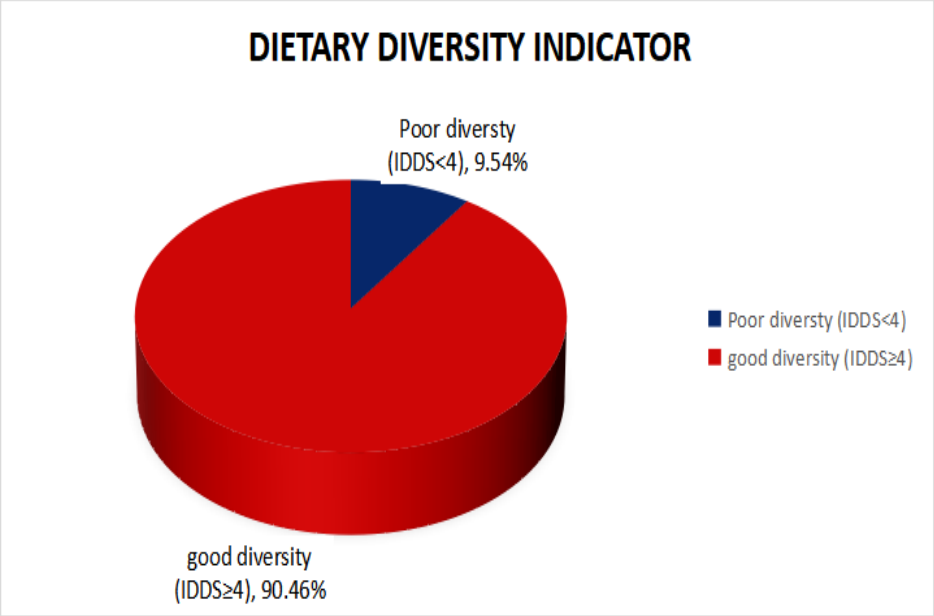

Figure 6: Dietary Diversity Classification of Primary School Pupils in Makurdi LGA of Benue State

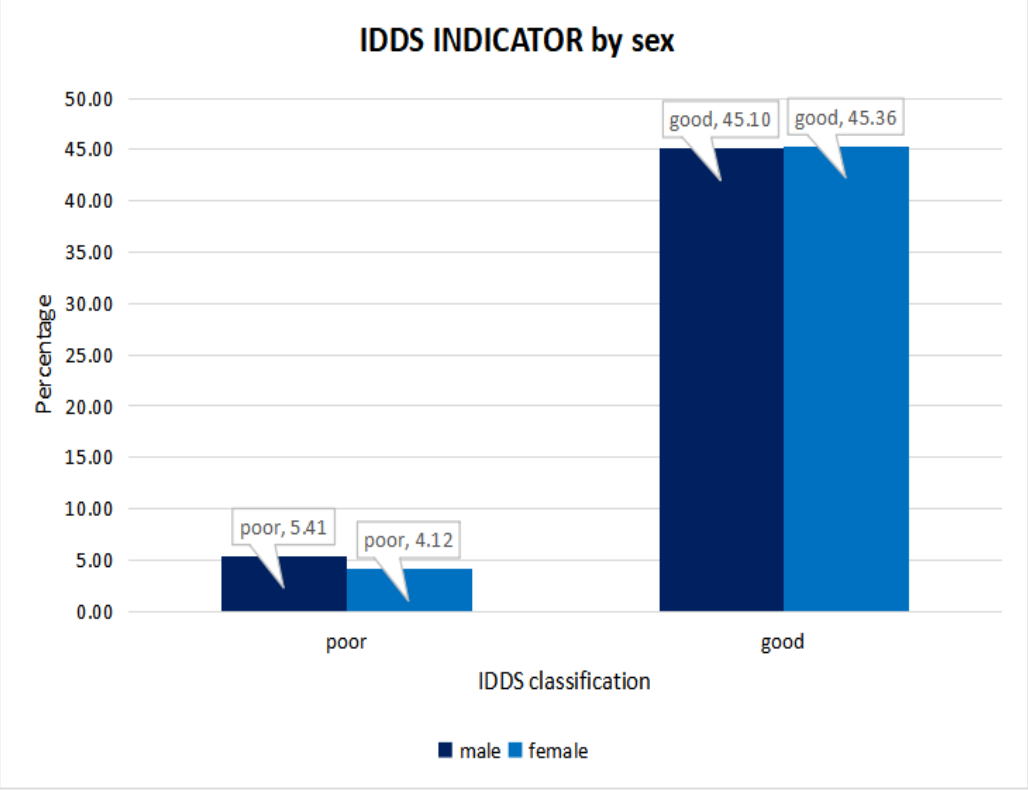

Figure 7: Individual Dietary Diversity Score Classification by Gender of Primary School Pupils in Makurdi LGA of Benue State

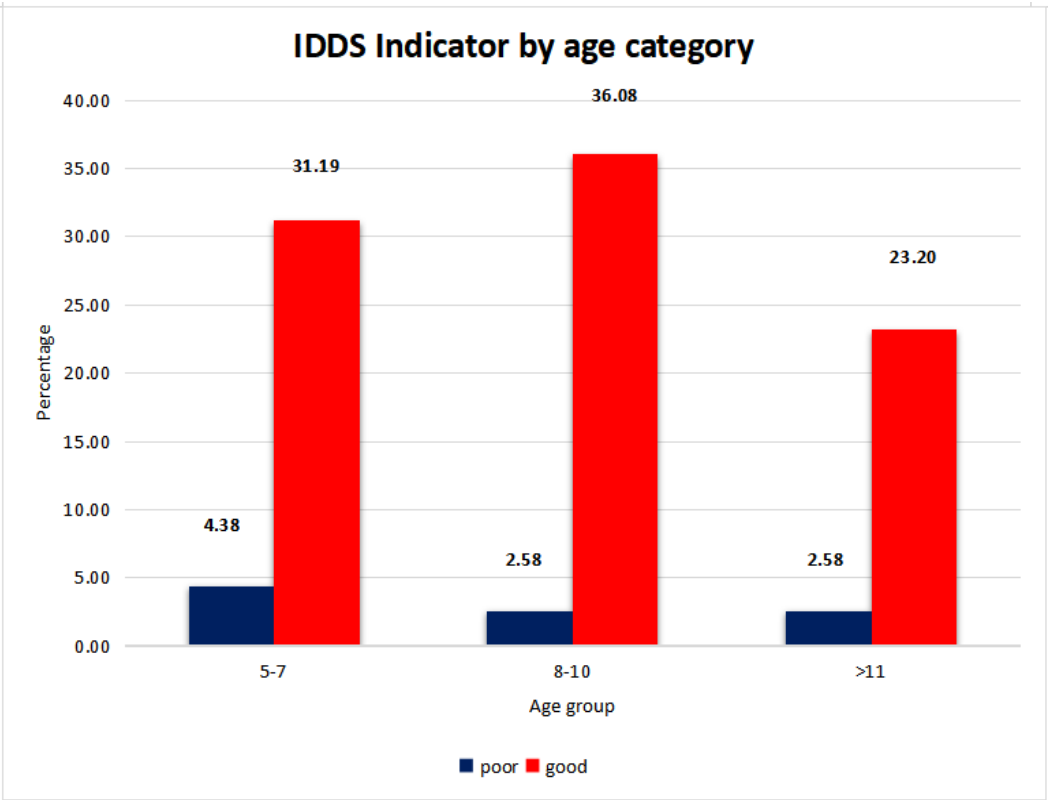

Figure 8: Individual Dietary Diversity Score Classification by age Category of Primary School Pupils in Makurdi LGA of Benue State

Relationship between Food Groups Consumed and Dietary Diversity of Primary School Pupils in Makurdi LGA

Table 2a shows the relationship between food groups consumed by the respondents and their dietary diversity. The percentage of respondents who consume each food group and the percentage of respondents with poor and good dietary diversity was recorded. A significant association was found (X^2= 19.421, p = 0.000*) between dietary diversity and dark green leafy vegetable consumption. Only 2.7% of individuals with good dietary diversity reported not consuming these vegetables while 15.8% of those with poor dietary diversity did not consume them. Similar to dark green leafy vegetables, a significant association was observed (X^2= 19.323, p = 0.000*) between dietary diversity and consuming vitamin A-rich fruits and vegetables. Only 1.3% of individuals with good dietary diversity did not consume these fruits and vegetables compared to 14.8% in the poor dietary diversity group. A significant association was found (X^2 = 5.867, p = 0.015*) between dietary diversity and other fruits and vegetables consumption. Those with poor dietary diversity had a higher percentage (18.5%) of individuals not consuming these

Table 2a: Relationship between Food Groups Consumed by the Respondents and Dietary Diversity of the Study Population

Food Groups	Dietary diversity		X^2	P-value
	Poor n (%)	Good n (%)		
Starchy staples				
No	0 (0.0)	0 (0.0)	NA	NA
Yes	37 (9.5)	351 (90.5)		
Dark green leafy vegetables				
No	32(158)	170 (84.2)	19.421	0.000*
Yes	5 (2.7)	181 (97.3)		
Vitamin A-rich fruits and vegetables				
No	35 (14.8)	202 (85.2)	19.323	0.000*
Yes	2 (1.3)	149 (98.7)		
Other fruits and vegetables				
No	10 (18.5)	44 (81.5)	5.867	0.015*
Yes	27 (8.1)	307 (91.9)		
Meat and fish				
No	10 (15.4)	55 (84.6)	3.096	0.078
Yes	27 (8.4)	296 (91.6)		

Food Groups	Dietary diversity		X^2	P-value
	Poor n (%)	Good n (%)		
Eggs				
No	36 (13.8)	224 (86.2)	16.971	0.000*
Yes	1 (0.8)	127 (99.2)		
Legumes, nuts and seeds				
No	28 (12.9)	189 (87.1)	6.471	0.011*
Yes	9 (5.3)	162 (162)		
Milk and milk products				
No	35 (16.9)	172 (83.1)	27.955	0.000*
Yes	2 (1.1)	179 (98.9)		

*The Chi-square (X^2) Statistic is Significant at $p < 0.05$ level

Relationship between Food Consumption Pattern and Dietary Diversity of Primary School Pupils in Makurdi LGA

Table 2b shows the relationship between food Consumption Pattern and Dietary diversity of pupils in Makurdi LGA of Benue State. The result is presented in percentages of pupils with poor and good dietary diversity scores for each food group consumed daily, twice, thrice, four to six times, once a week, or never. Majority of the participants (87.9%) reported consuming cereals daily. Twice a week consumption was reported by a (100%) in the Good category. No significant difference was observed in the consumption pattern between the two groups ($\mathbf{X^2}$= 4.046, P = 0.400). A significantly higher proportion of participants with a Good dietary diversity reported daily consumption of roots and tubers compared to those with a "Poor" dietary diversity ($\mathbf{X^2}$= 14.296, P = 0.014*). The "Good" group showed higher frequency across all categories, indicating a diverse consumption pattern. Daily consumption of milk and milk products was more prevalent in the "Good" group, and this difference was statistically significant ($\mathbf{X^2}$ = 16.765, P = 0.005*). The "Good" group exhibited higher consumption across all categories, suggesting a more diverse intake of dairy products.

Participants with a "Good" dietary diversity showed a significantly higher daily consumption of meat, fish, and eggs ($\mathbf{X^2}$= 10.987, P = 0.027*). This indicates a positive association between dietary diversity and the inclusion of animal protein sources. No significant difference was observed in the consumption pattern of nuts and legumes between the two groups ($\mathbf{X^2}$= 5.434, P = 0.365). Both groups reported relatively high consumption frequencies, suggesting a common dietary habit. The "Good" group reported a higher frequency of daily fruit consumption, but the difference was not statistically significant ($\mathbf{X^2}$ = 6.246, P = 0.283). A highly significant difference was observed in the daily consumption of vegetables between the "Poor" and "Good" groups ($\mathbf{X^2}$= 41.187, P = 0.000*). The "Good" group exhibited a diverse vegetable consumption pattern across all categories emphasising the importance of vegetable intake for dietary diversity.

Table 2b: Relationship between food Consumption Pattern and Dietary Diversity of Primary School Pupils in Makurdi LGA

Food consumption pattern	Dietary diversity		X^2	P-value
	Poor n(%)	Good n(%)		
Cereals and cereals products				
daily	24(12.1)	174 (87.9)		
Twice	0 (0.0)	5 (100.0)	4.046	0.400
Thrice	2 (4.3)	45(95.7)		
Four to six times	11 (8.0)	126 (92.0)		
once	0 (0.0)	0 (0.0)		
never	0 (0.0)	1 (100.0)		
Roots and Tubers				
daily	8 (19.5)	33 (80.5)		
Twice	4 (6.3)	60 (93.8)		
Thrice	8 (5.2)	146 (94.8)	14.296	0.014*
Four to six times	17(14.9)	97 85.1)		
once	0 (0.0)	13 (100)		
never	0 (0.0)	2 (100)		
Milk and Milk products				
daily	0 (0.0)	7 (100)		
Twice	10 (7.4)	126 (92.6)	16.765	0.005*
Thrice	5 (5.2)	91 (94.8)		
Four to six times	1 (2.7)	36 (97.3)		
once	8 (17.4)	38 (82.6)		
never	13(19.7)	53 (80.3)		
Meat, Fish, and Eggs			10.987	0.027*
daily	0 (0.0)	4 (100.0)		

Food consumption pattern	Dietary diversity		X^2	P-value
	Poor n(%)	Good n(%)		
Twice	5 (17.9)	23 (82.1)		
Thrice	30(11.8)	224 (88.2)		
Four to six times	2 (2.0)	98 (98.0)		
once	0 (0.0)	2 (100.0)		
never	0 (0.0)	0 (0.0)		
Nuts and Legumes				
daily	0 (0.0)	1 (100.0)		
Twice	11 (9.6)	103 (90.4)	5.434	0.365
Thrice	14 (8.8)	145 (91.2)		
Four to six times	11(15.1)	62 (84.9)		
once	1 (4.5)	21 (95.5)		
never	0 (0.0)	19 (100.0)		
Table 2b: Continued				
Fruits				
daily	0 (0.0)	1 (100.0)		
Twice	17(11.6)	129 (88.4)		
Thrice	1 (2.3)	43 (97.7)	6.246	0.283
Four to six times	0 (0.0)	1 (100.0)		
once	6 (6.3)	90 (93.3)		
never	13(13.0)	87 (87.0)		
Vegetables				
daily	0 (0.0)	1 (100.0)		
Twice	12(10.9)	98 (89.1)		
Thrice	12 (5.6)	203 (94.4)	41.187	0.000*
Four to six times	0 (0.0)	22 (100.0)		
once	6 (22.2)	21 (77.8)		
never	7 (53.8)	6 (46.2)		

*The Chi-square (X^2) Statistic is significant at $p < 0.05$ level

Demographic Parameters as Predictors of Dietary Diversity

Table 3 presents some demographic parameters as predictors of dietary diversity of the study population. The variables entered in the analysis include age category, class of respondents (in primary of class), family size, and household head occupation. The logistic regression analysis results, including the beta coefficients, standard errors, Wald statistics, degrees of freedom, and p-values were recorded. The result shows that family size and occupation of household heads are significant predictors of dietary diversity ($p < 0.001$). At the same time, age category and class of respondent are not significant predictors. Overall, the results suggest that family size and occupation of household head may be important factors to consider when designing interventions to improve dietary diversity among primary school pupils in Makurdi LGA.

Table 3: Some Demographic Parameters as Predictors of Dietary Diversity of the Study Population

	B	S.E.	Wald	Df	Sig.	EX(B)	95% C.I. for EX(B)	
							Lower	Upper
Age category	.325	.507	.412	1	.521	1.384	.513	3.735
Class of Respondent (in Primary of class)	-.043	.220	.038	1	.845	.958	.623	1.473
Family size								
Occupation of the household head	-1.391	.402	11.989	1	.001	.249	.113	.547
Constant	.373	.113	10.873	1	.001	1.452	1.163	1.812
	2.722	.857	10.094	1	.001	15.207		

a. Variable(s) entered on step 1: Age category, Class of Respondent (in Primary of class), Family size, occupation of the head of household

Key:
B = Beta coefficient
S.E = Standard errors
Wald = Wald statistics
DF = Degree of freedom
Sig = Significance
EX (B) = Exponential of coefficient
C.I = Confidence Interval

Discussion

Demographic Variables

The demographic characteristics of the pupils examined were gender, age category, respondent's class, household head occupation, household size, and average number of children in the home. These demographic variables are essential for understanding the context in which dietary diversity and food consumption patterns are assessed. The occupation of the

household head was categorised, with artisans having the highest frequency and percentage, followed by civil servants and traders. This information is crucial for identifying potential socio-economic factors that may influence dietary diversity and food consumption patterns among primary school pupils in the region. Artisan and trader household heads showed high frequencies, possibly suggesting diverse income sources that could afford more varied diets (Ayogu, 2019). Findings from the present study are in line with the study by Taren *et al*. (2014) which stated income of parents is also a crucial factor in determining the nutritional status of a family. It directly affects the affordability and access to nutritious food, which is essential for a nutritionally sound diet (Table 1).

Dietary Intake and Diversity

The consumption of various food groups by the respondents shows varying consumption levels for different food groups, with starchy staples having the highest consumption (100%), followed by other fruits and vegetables (86.08%), meat and fish (83.25%), dark green leafy vegetables (47.94%) and milk and milk products (46.65%). This information is crucial for understanding the frequency of consumption of different food groups in assessing dietary diversity and nutritional adequacy among pupils (FAO, 2011). The findings are consistent with previous researches emphasising the significance of protein-rich foods and dairy products in promoting dietary diversity and overall nutritional status (Givens, 2020) (Figure 2a).

The food consumption pattern shows the respondent's percentage consumption of various food groups. The results indicate that cereals and cereal products are consumed most daily, followed by roots and tubers while fruits and vegetables are relatively low. Food consumption patterns are presented in categories with cereals and cereal products having the highest daily consumption at 51.0%, while fruits and vegetables had low daily consumption rates at 6.3% and 10.9% respectively. This finding highlights potential gaps in the consumption of essential food groups contributing to dietary diversity. It aligns with the study by Ijarotim (2013) who noted that starchy staples particularly cereals, dominate diets in many parts of Nigeria. FAO (2004) emphasised on the low consumption rates of fruits and vegetables, thereby, highlighting its importance for overall health and nutrition. However, this observation differs from the findings reported in Egypt by El-Sabely *et al.* (2013) where there was significantly higher frequency of fruits intake among pupils in primary schools. El-Sabely *et al.* (2013) also noted that regular intake of fruits helps with digestion and provides micronutrients for the body, and eating fruits regularly can be implemented by including fruit consumption as part of the nutrition education in the school nutrition curriculum and creating fruit days in the primary schools. This helps children adopt healthy food habits at an early age such that it cannot be easily reversed (Figure 2b).

The individual dietary diversity score (IDDS) also shows the percentage of pupils with different dietary diversity scores. The results indicates that a significant proportion of pupils achieved a moderate dietary diversity score, with 39.69% having an IDDS of 5, followed by 27.06% and 21.13% with scores of 4 and 6 respectively. The percentage of pupils and their individual dietary diversity score in this study was similar in value to results observed by Stein *et al*., (2015) but lower than values observed in studies conducted by Owusu (2013) and Olumakaiye (2013). The difference observed may be attributed to the fact that, the FAO individual dietary diversity food group was used in the study conducted by Owusu (2013) which recorded both foods provided by the school feeding programme and foods eaten at home, thus increasing the variety of foods consumed in a day while Olumakaiye (2013) used the FANTA household dietary diversity score indicator which contains sixteen food groups to assess dietary diversity and giving the participants better chance of having a high dietary diversity score (Figure 2c).

The Individual Dietary Diversity Score (IDDS) by sex and age category provides valuable insights into the dietary diversity of primary school pupils in Makurdi LGA. From the findings, 90.46% of the study group had good dietary diversity (IDDS≥4), while 9.54% had poor diversity (IDDS<4) (Figure 2f). When examining the IDDS by sex, the results showed that 86.54% of boys and 94.27% of girls had good dietary diversity scores. This goes contrary to the observations made by Olumakaiye (2013) in Osun state of Nigeria, where boys in the primary schools had a significantly higher mean individual dietary diversity score compared to girls in same schools. This implies that the boys had a more adequate food and nutrient intake compared to their counterparts in the schools. This finding also indicates that pupils who have a higher mean dietary diversity score may be more nutrient sufficient and perform better. The higher percentage of girls with good dietary diversity scores compared to boys in this present study suggests potential gender disparities in dietary intake and diversity among the study population. This indicates varying access to consumption of diverse and nutrient-rich foods between boys and girls, highlighting the need for targeted interventions to ensure equitable access to a diverse and balanced diet for all pupils regardless of gender (Deslippe et al., 2023; Ochieng et al., 2017).

Additionally, the IDDS by age category reveals that 31.19% of the pupils aged 5-7 had good dietary diversity, while 36.08% of pupils aged 8 -10 and 23.20% of pupils aged 11 years and above also had good dietary diversity respectively. The differences in dietary diversity across the age categories indicate potential variations in food consumption patterns and nutritional intake among different age groups (UNICEF, 2020). This is similar to observations made by Olumakaiye (2013) in Osun state of Nigeria who stated that participants in age 8 – 10 category tend to have a better variety of food group intake and consequently, better nutrient adequacy compared to the pupils in age 5 – 7 and age 11 years above category. This underscores the importance of considering age-specific dietary preferences and nutritional needs when designing interventions to improve dietary diversity and overall nutritional status among primary school pupils (Figure 8).

The relationship between dietary intake, dietary diversity, and the nutritional status of pupils in Makurdi LGA is multifaceted and crucial for understanding the overall health and well-being of the pupils. The findings from the study indicates that dietary diversity is significantly associated with the consumption of specific food groups, such as roots and tubers, milk and milk products, meat, fish, eggs, and vegetables. This suggests that a more diverse diet, including various nutrient-rich foods is linked to better dietary diversity among the pupils (WEP, 2012). The consumption of these food groups is essential for providing essential nutrients, including protein, vitamins, and minerals which is vital for growth, development and overall health (Adebukola et al., 2017; Khamis et al., 2019). Furthermore, the study revealed that good dietary diversity was associated with higher consumption of dark green leafy vegetables, vitamin A-rich fruits and vegetables and milk and milk products (Table 2a).

The study evaluated the relationship between food consumption patterns and dietary diversity among primary schools pupils in Makurdi LGA of Benue State, Nigeria. It

highlights that pupils with good dietary diversity consume various foods across different food groups. The high daily consumption of cereals (87.9%) among participants as observed in the study aligns with the study by Ijarotimi (2013) which stated that starchy staples, particularly cereals dominate diets in many parts of Nigeria Conversely, increased daily consumption of roots and tubers among pupils with good diversity has been seen to be consistent with findings from other studies in Nigeria that suggest root crops are important in the diets of many Nigerians (Karya et al., 2019). Moreover, the significant difference in vegetable consumption between the "Good" and "Poor" diversity groups with higher consumption noted in the "Good" group indicates an understanding of the importance of vegetables for nutritional diversity which is often emphasised in nutrition education (Torheim et al., 2004). Milk and dairy product consumption was higher in the "Good" dietary diversity group. This is notable because Milk and milk products are rich in proteins and minerals which are beneficial to human health, they are considered complete foods as they prevent over-consumption of energy and contain all macronutrients and high concentrations of mineral elements such as sodium, potassium, iron, calcium, magnesium, selenium, copper and zinc (Alewy *et al*., 2022). The positive association between dietary diversity and the inclusion of animal protein sources like meat, fish, and eggs may reflect the understanding that animal-based foods are important sources of high-quality protein and micronutrients such as iron and zinc which are critical for children's growth (Modjadji et al., 2020). There was, however, no significant difference in the consumption pattern of nuts and legumes. This suggests that such foods are commonly consumed among children, possibly reflecting their affordability and availability (Arimond & Ruel, 2004). Low daily fruit consumption was reported, which might reflect access and affordability issues in regions where fruit availability is seasonal or cost-prohibitive (FAO, 2004) (Table 2b).

Some demographic parameters were identified as predictors of dietary diversity in the study population. This includes age category, class of respondent (in primary class), family size, and occupation of the head of household. The study revealed that family size and the occupation of the head of the household were significant predictors of dietary diversity. At the same time, age category and respondent class were insignificant predictors. The implications of these predictors are significant for understanding the factors that influence dietary diversity among primary school pupils in Makurdi LGA. The importance of these predictors lies in their potential impact on the study population dietary habits and nutritional intake. According to FAO (2011), family size may influence dietary diversity through household food availability, meal planning, and food access. Also, larger families may have different dietary patterns and access to diverse food options compared to smaller families which can impact overall dietary diversity. Similarly, the occupation of the head of the household can influence the economic resources available for purchasing diverse and nutritious foods, as well as the knowledge and attitudes towards dietary choices and nutrition within the household (Ayogu, 2019). Understanding the influence of these demographic parameters on dietary diversity is crucial for designing targeted interventions and public health strategies to improve the nutritional status and overall health of primary school pupils in Makurdi LGA. By addressing factors such as family size and the occupation of the head of the household, interventions can be tailored to promote access to diverse and nutrient-rich foods, ultimately supporting optimal dietary diversity and nutritional outcomes among the study population (Table 3).

CONCLUSION

The consumption of common starchy staples in the locality was prevalent, followed by roots and tubers. The consumption of animal and plant sources of protein (eggs, fruits, fish and other seafood) and vegetables was inadequate, and this could affect growth and development. The findings reinforce the importance of continued nutrition education of mothers, caregivers and preschool staff on the need to ensure the consumption of diverse food sources, in order to improve the nutritional status of children. Further studies should be carried out on factors associated with low dietary diversity among preschool children.

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