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Research

Household dietary diversity and nutritional status of preschool children in semi-urban and rural communities of Umuahia South Local Government Area, Abia State, Nigeria

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Background

The nutritional well-being of preschool children (2–4 years) is critical to achieving Sustainable Development Goal 2 (Zero Hunger).

Objective

The purpose of the study was to assess the household dietary diversity score (HDDS) and the nutritional outcomes of preschool children in Umuahia South Local Government Area (LGA), Abia State, Nigeria.

Methods

A community-based cross-sectional study was conducted in six randomly selected communities in the LGA. Data were collected from mother–child pairs in 318 systematically sampled households. A semi-structured questionnaire was used to collect data on socio-demographics, HDDS, and individual dietary diversity score (IDDS) of preschool children. Children's weight and height were measured and analysed using WHO Anthro software, based on WHO Child Growth Standards. Data were analysed using descriptive statistics (frequencies, percentages, means, and standard deviations) and Chi-square tests, with statistical significance set at $p < 0.05$.

Results

Most households were small (1–5 members; 64.5%), and had low income (< N70,000 per month; 66.4%). Most households (67.6%) and preschool children (52.8%) did not meet minimum dietary diversity (MDD) thresholds (⩾6 food groups for households and ⩾4 food groups for children). The prevalence of malnutrition among children was 25.5% for stunting, 7.9% for wasting, 15.7% for underweight, and 3.1% for overweight/obesity based on WHO growth standard z-scores. Stunting was significantly associated with household and IDDS, income, and maternal education ($p < 0.05$). Underweight was associated with household size and IDDS.

Conclusions

Most of these preschool children did not meet MDD, and this was associated with high rates of stunting and underweight. Also, large household size and low income were strongly associated with underweight. Interventions to improve dietary diversity to enhance the nutritional outcomes of preschool children should be prioritized.

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INTRODUCTION

The global burden of malnutrition, particularly among preschool children, has become a critical public health issue that continues to challenge governments, non-governmental organisations, and international agencies. Malnutrition manifests as stunting, wasting, underweight, and overweight among children under five, and is associated with increased child morbidity and mortality. Dietary diversity is increasingly recognised as a proxy indicator of diet quality and micronutrient adequacy, which in turn influence children's nutritional status (Azupogo et al. 2022).

In regions such as sub-Saharan Africa, numerous reports from governmental agencies and development stakeholders emphasise the critical importance of a diversified diet in mitigating the risk of malnutrition. According to Azupogo et al. (2022), national surveys and government health reports in Ghana have repeatedly highlighted that approximately one-fifth of children under the age of five suffer from stunting, while significant proportions are also underweight or wasted. Seasonal variations in food security further exacerbate the magnitude of undernutrition across these settings; during lean seasons, when access to a wide range of nutrient-dense foods is limited, children's diets become predominantly plant-based, with minimal intake of animal-source foods (Azupogo et al., 2022).

The 2015–2016 Tanzania Demographic and Health Survey (TDHS) provided robust evidence indicating that a significant majority of children aged 6–23 months do not meet the minimum dietary diversity (MDD) criteria recommended by WHO (Khamis et al., 2019). In practical terms, this means that most children in these regions consume diets that are inadequate in both quality and variety, thereby predisposing them to nutrient deficiencies that affect physical growth, cognitive development, and overall health. In India, Nithya and Bhavani (2018) explored the relationship between dietary diversity indices, calculated using 24-hour diet recall and food frequency questionnaire, and nutrient adequacy. Their findings indicate that higher diversity scores were associated with better nutrient intake, particularly for protein and energy, although the associations with anthropometric outcomes were not consistent across all indices.

Furthermore, several systematic reviews and meta-analyses have reinforced these empirical findings, demonstrating that interventions to improve dietary diversity can significantly improve children's nutritional status. Consumption of animal-source foods, fruits, and vegetables has been associated with a reduced risk of stunting and anaemia, particularly when these foods are introduced as part of a complementary feeding regimen (Saaka & Galaa, 2017). This review also highlights the complexity of nutritional outcomes, which are influenced by a host of factors, including socioeconomic status, maternal education, and household food security. By controlling for these confounders, some studies have been able to isolate the independent effect of dietary diversity on nutritional outcomes, thereby providing robust evidence of its importance as a public health metric (Saaka & Galaa, 2017; Khamis et al., 2019). WHO recommends that children aged 6–23 months consume foods from at least 4 of the 7 food groups to meet their nutritional needs (Saaka & Galaa, 2017). This recommendation has been operationalized in many studies using dietary diversity scores (DDS) ranging from 0 to 7, depending on the number of food groups considered (Azupogo et al., 2022; Khamis et al., 2019).

Recent data from the 2024 Nigeria Demographic and Health survey (NDHS) reveal that 40% of children under five are stunted, 8% are wasted, and 27% are underweight, underscoring the gravity of the issue in the national context. This level of malnutrition has been attributed to recurring inadequate intake of diet both in quality and quantity (NDHS, 2024).

The present study is situated within the context of the study area (Umuahia South Local Government Area, Abia State, Nigeria), where malnutrition remains a pressing challenge despite ongoing interventions (NDHS, 2024). This research is unique in that it focuses on the period when preschool children are fully integrated into family meals, a stage that is critical for determining long-term nutritional outcomes. Thus, this study aimed to assess household dietary diversity scores (HDDS) and their association with the nutritional status of children 2-4 years old.

METHODS

STUDY DESIGN

A community-based cross-sectional design was used to simultaneously assess HDDS and nutritional status among preschool children in semi-urban and rural communities in Umuahia South.

AREA OF STUDY

Umuahia South Local Government Area (LGA) is in Abia State, Nigeria. The area is predominantly inhabited by the Igbo ethnic group, with a population of approximately 139,000 people in 2006 (National Population Commission, 2006), projected to be about 203,000 now. Predominantly agrarian livelihoods characterise Umuahia South LGA, where households are engaged in subsistence farming and small-scale trading. The region experiences seasonal variations in food availability, which impacts dietary diversity and nutritional outcomes, a situation analogous to those documented in Ghana and Tanzania (Azupogo et al., 2022; Saaka & Galaa, 2017). The study was conducted in semi-urban and rural communities within the LGA.

SAMPLING PROCEDURE

The study population comprised all preschool children aged 2–4 years and their primary caregivers residing in the selected communities. A total of 318 preschool children and caregivers participated in the study.

The sample size was determined using Cochran's single-proportion formula, considering the estimated prevalence of undernutrition among preschool children in similar rural settings, a margin of error of 5%, and a 95% confidence level. Adjustments were made for potential non-response (5%) based on similar methodologies employed in studies by Azupogo et al. (2022) and Khamis et al. (2019).

$$n = \frac{Z^2 \times p\,(1-p)}{e^2}$$

Where:

Z is the z-score corresponding to a 95% confidence interval (1.96),

P is the estimated prevalence of undernutrition – underweight, 27% (NDHS, 2024); and e is the margin of error (0.05).

$$n = \frac{1.962 \times 0.27 \times (1 - 0.27)}{0.05^2}$$

n = 303
5% x 303 = 15/ Thus, 15 + 303 = 318.

The study employed a multi-stage sampling method. The LGA was stratified into semi-urban and rural communities to ensure representation across these groups. The sample size of 318 preschool children was allocated across the areas, with 60% from semi-urban areas (due to anticipated high population density) and 40% from rural areas. Six communities were randomly selected from a list of wards, three from each of the semi-urban and rural areas. Within each selected community, households were sampled using systematic sampling, yielding 64 preschool children per semi-urban community and 42 per rural community. A random starting point was chosen in each community, and every 5th household was selected. In households with multiple eligible preschool children, simple random sampling was used to select one preschool child.

DIETARY ASSESSMENT
Information on the child's age, gender, and caregiver's socioeconomic characteristics was collected using a questionnaire. HDDS and individual dietary diversity score (IDDS) were assessed using a culturally specific, modified dietary diversity score adapted from the FANTA project (version 2) (Swindale & Bilinsky, 2006). Caregivers were asked to recall all foods consumed by the household members in the previous 24 hours. Data on various food groups consumed on the preceding day, adapted for local dietary practices, were collected. The data collection was conducted in local languages. Twelve food groups (HDDS) and eight food groups (IDDS) were used, as indicated in Table 1.

Table 1: Food groups

Food groups	Examples
Starchy foods	Rice, bread, pap, potatoes, *fufu*, plantain
Pulses	Beans, *moi-moi*, African yam beans
Nuts and seeds	Groundnut, melon seed, walnut, breadfruit seed, *ogbono* seed, cashew nut
Dairy products	milk powder, liquid milk, ice cream, yoghurt
Flesh foods	Cow meat, fish, goat meat, chicken, turkey, pork, fish, prawn, crab, shrimp
Egg	Egg
Dark green leafy vegetables	Pumpkin leaf, waterleaf, bitter leaf, *uziza*, *utazi*, *okazi*, garden egg leaf
Vitamin A-rich fruits and vegetables	Carrots, sweet potatoes, red *tatase*, pumpkin, mango, pawpaw, *ogbono* fruit.
Other vegetables	Okra, tomatoes, sweet potato leaf, cowpea leaf, green pepper, green beans
Other fruits	Avocado, pear, orange, tangerine, banana, grapefruit, guava
Cereal	Cornflakes, oats

HDDS was calculated by summing the number of food groups consumed by members of households over the 24-hour recalls. The population-level indicator is the number of households that consumed at least 6 of the 12 food groups on the previous day, divided by the total number of households. The population level indicator for the dietary diversity of the preschool children was:
Preschool children who consumed food from at least four of eight food groups during the previous 24 hours/Total number of preschool children.

ANTHROPOMETRIC MEASUREMENT: A Salter (London) weighing scale (checked for zero adjustment before each measurement) was used to measure the weight of the preschool children, and a stadiometer was used to measure their height. Measurements were taken to the nearest 0.1 kg and 0.1 cm, for weight and height, respectively.

The anthropometric data were processed using WHO Anthro-Software to calculate Z-scores for height-for-age, weight-for-age, and weight-for-height, with values < -2 SD, in accordance with WHO Growth Standards (WHO, 2006).

DATA ANALYSIS: Data were coded, entered, and cleaned using Excel (2013 version) and then imported to SPSS version 27. The analysis began with descriptive statistics to summarize background information, socioeconomic data, HDDS, IDDS (further classified into those with a low dietary diversity [LDD] – when an individual's diet lacks variety, consuming foods only from a few food groups -- and those that achieved the minimum dietary diversity [MDD], and anthropometric measurements. Inferential statistical methods were used to examine the relationships among HDDS, IDDS, and anthropometric status in these preschool children. The chi-square test was used to identify significant associations between HDDS/IDDS, socio-demographic variables, and categorical variables (stunting and underweight). Statistical significance level was set at $p < 0.05$.

RESULTS

Table 2 shows the socio-demographic characteristics of the preschool children and their caregivers. The mean age of the preschool children was 2.89 ± 0.79 years and the mean household size was 5.31 ± 1.10 members. Slightly more than half of the children were male (52.8%). Most caregivers had completed secondary education (62.9%), with a substantial proportion being traders (34.3%) and earning less than N70,000 per month (66.4%).

Table 2: Socio-demographic characteristics of preschool children and their caregivers

Variables	Frequency (n = 318)	Percentage
Age (mean age = 2.86 ± 0.79)		
2-4 years	318	100
Gender		
Male	168	52.8
Female	150	47.2
Religion		
Christianity	286	89.9
Islam	12	3.8
Traditional	20	6.3
Ethnicity		
Igbo	299	94.0
Hausa	8	2.5
Yoruba	11	3.5
Efik/Ibibio	-	-
Household size (5.31 ± 1.10)		
Small (1 – 5)	205	64.5
Large (6 and above)	113	35.5
Education attained		
No formal education	10	3.1
Primary education	28	8.8
Secondary education	200	62.9
Tertiary education	80	25.2

Variables	Frequency (n = 318)	Percentage
Occupation		
Civil/Public servant	105	33.0
Trading	109	34.3
Artisan	54	17.0
Private sector employed	10	3.1
Unemployed	40	12.6
Income level*		
Low (< ₦70,000)	211	66.4
High (₦70,000 and above)	107	33.6

*USD $1 = N1,451.52

Table 3 shows household food consumption by food group and dietary diversity. Household food consumption and dietary diversity were defined as food groups consumed by households within the past 24-hour period. Cereals (maize, millet, rice, wheat) were consumed by 97.2% of households, and 84.9% consumed vegetables. Fish (likely mainly dried) and seafood were consumed by 94.0%,

Table 3: Household food consumption in the previous 24 hours, categorized by food groups

Food groups	Frequency (n = 318)	Percentage (%)
Cereals		
Yes	309	97.2
No	9	2.8
Vegetables		
Yes	270	84.9
No	48	15.1
White root and		
tubers	108	34.0
Yes	210	66.0
No		
Fruits		
Yes	57	17.9
No	261	82.1
Meat		
Yes	128	40.3
No	190	59.7
Legumes, nuts,		
and seeds	188	59.1
Yes	130	40.9
No		
Milk and milk		
products	105	33.0
Yes	213	67.0
No		
Oil and fats		
Yes	178	56.0
No	140	44.0
Fish		
Yes	299	94.0
No	19	6.0
Egg		
Yes	25	7.9
No	293	92.1
Spices and		
condiments	312	98.1
Yes	6	1.9
No		
Sweets		
Yes	199	62.6
No	119	37.4

Table 4 shows HDDS. The mean dietary diversity of the households was 5.95 ± 0.95 food groups. Most households (67.6%) did not meet the HDDS, defined as consuming foods from at least 6 food groups in the previous 24 hours.

Table 5 shows the consumption of food groups among the preschool children. Grains, roots and/or tubers (100.0%) and legumes, nuts/seeds (56.9%) were the most-consumed food groups, with children consuming them at least once in the past 24-hour period.

Table 4: Household dietary diversity score

Dietary diversity score	Frequency (n = 318)	Percentage (%)	Mean ± SD
⩽ 5 food groups	215	67.6	5.95 ± 0.95
⩾ 6 food groups	103	32.4	

Table 5: Food groups consumed by sample preschool children during the previous 24 hours

Food groups	Frequency (n = 318)	Percentage (%)
Grains,		
roots/tubers	318	100.0
Yes	0	0.0
No		
Legumes,		
nuts/seeds	181	56.9
Yes	137	43.1
No		
Meat/poultry,		
fish, seafood	145	45.6
Yes	173	54.4
No		
Milk and milk		
products	149	46.9
Yes	169	53.1
No		
Eggs		
Yes	59	18.6
No	259	81.4
Vitamin A-rich		
fruits and		
vegetables	47	14.8
Yes	271	85.2
No		
Other		
fruits/vegetables	127	39.9
Yes	191	60.1
No		
Fats and oils		
Yes	295	92.8
No	23	7.2

Table 6 shows the dietary diversity of these preschool children. The mean dietary diversity of the children was 3.41 ± 0.16 out of 8 food groups; 52.8% failed to meet the MDD, defined as consuming at least 4 food groups in the past 24 hours.

Table 6: Minimum dietary diversity among preschool children

Dietary diversity	Frequency (n = 318)	Percentage (%)	Mean ± SD
Low diversity (⩽ 3 food groups)	168	52.8	3.41 ± 0.16
MDD (⩾ 4 food groups)	150	47.2	

MDD = minimum dietary diversity.

Table 7 shows the anthropometric status of the preschool children. Nearly half (47.8%) of preschool children had normal growth indicators, while 25.5% were stunted, 15.7% underweight, 7.9% wasted, and 3.1% overweight/obese.

Table 7: Anthropometric status of the preschool children

Indicator	Frequency (n = 318)	Percentage (%)
Normal	152	47.8
Stunting	81	25.5
Wasting	25	7.9
Underweight	50	15.7
Overweight or obese	10	3.1

z-score = <-2 SD

Table 8 shows the associations between socio-demographic and dietary diversity factors and children's height-for-age. HDDS, IDDS, education, and household income were significantly associated with height-for-age ($p < 0.05$).

Table 8: Factors associated with height-for-age of preschool children

Indicator (stunting)	Factors		p-value
	Household DDS		0.043
	LDD	MDD	
Stunted	46 (41.1)	35 (28.9)	
Normal	66 (58.9)	86 (71.1)	
	DDS (Child)		0.002
	LDD	MDD	
Stunted	58(49.6)	23(19.8)	
Normal	59(50.4)	93(80.2)	
	Child sex		0.789
	Male	Female	
Stunted	42(35.9)	39(33.6)	
Normal	75(64.1)	77(66.4)	
	Household size		0.472
	Small	Large	
Stunted	31(25.4)	50(45.0)	
Normal	91(74.6)	61(55.0)	
	Household income		0.000
	Low	High	
Stunted	52(45.2)	29(24.6)	
Normal	63(54.8)	89(75.4)	
	Mother's education level		0.010
	Low	High	
Stunted	65(49.2)	16(15.8)	
Normal	67(50.8)	85(84.2)	

Values in parentheses = percentages. High education = secondary and tertiary; low education = primary and no formal education; LDD = low dietary diversity; MDD = minimum dietary diversity; DDS = dietary diversity score; low income = < N70,000.00; high income = N70,000 and above.

Table 9 shows the association between socio-demographic and diet diversity factors and weight-for-age. Among the various factors examined, individual (child) dietary diversity and household size were significant.

Table 9: Factors associated with weight-for-age of preschool children

Indicator (underweight)	Factors		p-value
	Household DDS		
	LDD	MDD	0.059
Underweight	24(24.7)	26(24.8)	
Normal	73 (75.3)	79(75.2)	
	DDS (Child)		0.002
	LDD	MDD	
Underweight	27(36.0)	23(18.1)	
Normal	48(64.0)	104(81.9)	
	Child sex		0.089
	Male	Female	
Underweight	28(28.6)	22(21.2)	
Normal	70(71.4)	82(78.8)	
	Household size		0.001
	Small	Large	
Underweight	20(18.2)	30(32.6)	
Normal	90(81.8)	62(67.4)	
	Household income		0.052
	Low	High	
Underweight	29(27.4)	21(21.9)	
Normal	77(72.6)	75(78.1)	
	Mother's education level		0.065
	Low	High	
Underweight	25(27.4)	25(22.3)	
Normal	65(72.6)	87(77.7)	

Values in bracket = percentages. High education = secondary and tertiary; low education = primary and no formal education; LDD = low dietary diversity; MDD = minimum dietary diversity; DDS = dietary diversity score.

DISCUSSION

The present study categorised household food consumption into the 12 food groups developed by FAO (2011). The HDDS not only reflects diet quality but is also a good indicator of a household's economic ability to access a variety of foods.

Our findings indicate a substantial lack of dietary diversity, with most households failing to meet the HMDD. This can be compared with Nyango & Alhassan (2025), who reported a greater proportion of households in a Ghanaian study achieving minimal diversity.

Furthermore, most preschool children in the present study failed to achieve the recommended MDD over the preceding 24-hour period, which is generally associated with better nutritional outcomes in children (International Food Policy Research Institute, 2005; Adepoju & Ayodele, 2019). This indicates their diets may be monotonous and primarily composed of starchy staples, directly reflecting the low dietary diversity found at the household level. The children's mean dietary diversity score of 3.41 (out of eight food groups) may be compared to scores found in Nigeria and beyond, such as the 3.24 reported by Adepoju & Ayodele (2019) for seven food groups, 3.6 reported by Steyn et al. (2006) for nine food groups, and 3.57 reported by Nyango & Alhassan (2025) for seven food groups. However, the score reported in the present study remains below the recommended MDD. This lack of a varied diet can hinder young child development and have long-term health implications (Arimond & Ruel, 2004; Nyango & Alhassan, 2025).

We found a 25% prevalence of stunting, lower than that reported by Adepoju & Ayodele (2019) (53.3%), the Nigeria Demographic Health Survey [NDHS] (2023-24) (40%), and Ali et al. (2017) (28.2%). The 7.9% prevalence of wasting in this study is comparable to the rates of 7% and 8% reported by NDHS in 2018 and 2023-24, respectively. In contrast, the 15.7% prevalence of underweight is lower than the 22% and 27% reported by the NDHS for the same periods, and lower than the 34.7% reported by Goson et al. (2022) in the Northern Zone of Nigeria. However, the 3.1% prevalence of overweight and/or obesity is higher than the 2% and 1% found in the NDHS data for the same periods. The coexistence of undernutrition and overweight is consistent with a double burden of malnutrition.

We found a strong link between both household and individual dietary diversity scores and stunting among preschoolers. This may be attributed to low household income and maternal education, as these socioeconomic factors were also significantly associated with stunting. This outcome contrasts with previous studies by Olumakaiye (2013) in Nigeria and Nyango & Alhassan (2025) in Ghana, who found no such relationship.

Underweight prevalence is a key indicator of malnutrition, reflecting both stunting and wasting. This study found that two variables (low dietary diversity and large household size) were statistically significantly associated with an increased prevalence of underweight among preschool children in the study area. These findings suggest that both a lack of dietary diversity and the influence of larger households on portion sizes may contribute to underweight. While we did not collect data on portion sizes, this is a plausible explanation, and it is in line with the study by Livingstone & Pourshahidi (2014) who reported that portion size represented an environmental factor contributing to malnutrition. The present study's findings are consistent with those of Adepoju & Ayodele (2019) and Tarini et al. (1999). Still, they diverge from those of Olumakiye (2013), who reported no such link between dietary diversity and children's nutritional status (underweight). These findings are consistent with the broader economic challenges and food insecurity documented in Nigeria, where many households struggle to achieve adequate dietary diversity.

CONCLUSION

We found that most households and preschool children in our sample did not meet the minimum dietary diversity threshold, which was associated with high rates of stunting and underweight. The study also established a strong connection between large household sizes, low-income status, and an increased risk of a child being underweight. The outcomes of this study highlight the urgent need for targeted nutrition interventions. These programmes should combine nutrition-specific and nutrition-sensitive strategies to improve household access to diverse diets and the nutritional status of preschool children.

LIMITATIONS

For some of our variables, as reflected in Tables 8 and 9, there were many missing values. Unlike many studies of dietary diversity, we used a single 24-hour recall rather than a one-week recall, which would have provided more detailed insight into individual consumption patterns with respect to diet quality. The definitions we used for HDDS and IDDS were also designed for research based on dietary assessments over a longer time period. Thus, the conclusions we have drawn should be viewed with caution. We did not assess food portion sizes or directly measure household food security, which would have provided a more detailed understanding of the pathways linking dietary diversity and nutritional status. Furthermore, the cluster sampling design was not accounted for in the analysis, which may have led to an underestimation of standard errors.

AUTHOR CONTRIBUTIONS

Conceptualization (IO); Methodology (IO, BKN and NJE); Validation (IO, BKN, EKA and NJE); Formal Analysis (IO); Investigation (IO, BKN, EKA and NJE); Resources (IO, BKN, EKA and NJE), Data Curation (IO, BKN, EKA and NJE); Writing – Original Draft Preparation (IO); Writing – Review & Editing (IO and BKN); Visualization (IO); Supervision (IO, BKN, EKA and NJE); Project Administration (IO and NJE); Funding Acquisition (IO, BKN, EKA and NJE). All authors have read and approved the final version of the paper and its submission and have given consent for publication.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN SCIENTIFIC WRITING

Nothing to disclose.

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