Predictors of Dietary Diversity and its Association with Nutritional Status and Academic Performance of Primary School Children in Anambra State, Nigeria

Onyeje Blessing Tochukwu[1];Ilo, Clementine Ifeyinwa[2]; Odira, Chika Chioma[3]; Ogbuji, Cynthia Chizoba[4]

[1]Department of Nursing Science, Chukwuemeka Odumegwu Ojukwu University, Anambra State
[2]Department of Nursing Science, Nnamdi Azikiwe University, Nnewi Campus, Anambra State
[3]Department of Nursing Science, Nnamdi Azikiwe University, Nnewi Campus, Anambra State
[4]Department of Nursing Science, Edo State University, Uzairue
Correspondence: Onyeje, Blessing Tochukwu

Abstract

Intake of diverse food sources is very vital as it provides the foundation for optimum health, cognitive development and academic achievement, especially during the school age. **Aim**: to determine predictors of dietary diversity and its association with nutritional status and academic performance of primary school children in Anambra State, Nigeria. **Materials and methods:** a cross-sectional analytical survey involving primary school children from two selected local government areas (one urban and one rural) of Anambra State was carried out over a 3 month period. A total of 637 participants comprising 297 males and 340 females were selected using multistage sampling technique. Interviewer-administered questionnaires were used to obtain needed information from the pupils and their parents/guardians. Anthropometric parameters such as height and weight were measured using a digital scale and a measuring tape. Nutritional status was determined using the WHO AnthroPlus version 1.0.4 and data was analyzed using SPSS version 25. **Findings**: Findings revealed that 92.0% of study participants met the minimum dietary diversity score and dietary diversity was significantly associated with nutritional status and academic performance. Factors such as increasing age (AOR=1.23, 95%CI: 1.10-1.37, p=0.000); urban residence (AOR=4.12, 95%CI: 2.62-6.49, p=0.000); attending private schools (AOR=2.25, 95%CI: 1.40-3.63, p=0.001); high household income (AOR=1.91, 95CI: 0.75-4.87, p=0.176); and high socioeconomic status (AOR=1.53, 95%CI: 0.83-2.82, p=0.175), increased the likelihood of having a high dietary diversity scores among primary school pupils. **Conclusion**: The present study showed that a high percentage of the population met the minimum dietary diversity and factors such as age, place of residence, type of family, type of school, parent's educational level and household monthly income significantly impacted the dietary diversity of primary school pupils.

Key words: Predictors, Dietary diversity, minimum dietary diversity, stunting, wasting, overweight, obesity, primary school children, association, academic performance

Introduction

Dietary diversity score is a good predictor of dietary adequacy and micronutrient density in children (Bandoh *et al.,* 2017; Moursi, *et al.,* 2008). Dietary diversity, which refers to the number of different food groups consumed in a given period, is a critical component of a high-quality diet (Okafor, *et al.,* 2020; Sié *et al.,* 2018). It has been recommended that a minimum dietary diversity of at least four food groups out of seven is needed to maintain optimal child growth and development (Modjadji, *et al.*, 2020). In other words, the more varied

and colourful a meal is the better its nutritional content. Nevertheless, it is concerning that many children, especially those from developing countries, still struggle to access adequate nutrition (Khamis, *et al.,* 2019) which may be related to factors such as parent's employment status (Ayogu, *et al.,* 2018); household income level (Adeomi, *et al.,* 2022; Drammeh, *et al.,* 2019); parent's educational status (Adedokun & Yaya, 2021; Soekatri *et al.,* 2020; Wolde *et al.,* 2015); family size (Ashagidigbi, *et al.,* 2022; Keno, *et al.,* 2021; Hailegebriel, 2020); family structure (Febrianti, *et al.,* 2022), amongst others.

The primary school age, which ranges from 6-12 years, is an important developmental period for accumulating knowledge and learning to understand society (Soto & Tackett, 2015). More so, it is an active phase of physical growth as well as mental development of the child (Patsa & Mukherjee, 2021; Sharma, *et al.,* 2017) and so the child is in greater need for good nutrition (Soheilipour, *et al.,* 2019; Uzosike, *et al.,* 2020) which is vital for physical growth and cognitive functioning (WHO, 2022).

According to Onyedika-Ugoeze (2018), the Southeast has the highest enrollment of primary school children estimated at 60.5%. Reports have shown that some pupils come to school without taking breakfast, while some are sent to school without food packs or with food packs containing nutrient poor staples (Ugochukwu*, et al.*, 2014). Despite Anambra State being a beneficiary of the National Home Grown School Feeding Programme (NHGSFP) of the Federal government of Nigeria which provides a meal each school day for primary 1-3 pupils in public schools (Anonymous, 2016), the state has not witnessed its optimal benefits, as the programme is froth with a lot of inconsistencies such as not all public schools are covered, meals are skipped sometimes, non-transparency, corruption and private schools not included in the programme (Ogbonnaya *et al.,* 2020; Ogunode & Abubakar, 2021). Thus, it has become the sole responsibility of parents/guardians to provide food for their children while in school which may be affected by their socioeconomic status (Ugochukwu, *et al.,* 2014). Consequently, these wards may stay until school dismissal without food and this may negatively impact their attention span, makes them easily irritable, and their academic performance may be greatly affected (de Onis & Branca, 2016).

Children with low dietary diversity suffer from various micronutrient deficiencies and this has posed palpable challenges among poor populations from low and middle-income countries (Bandoh *et al.,* 2017; Moursi, *et al.,* 2008); affecting the ability of such children to learn (Asmare, *et al.,* 2018). This has been exacerbated by current economic downturns, insecurity, climate change and poor agricultural yield; thus, with rising cost of food items an average household struggles to buy and eat what constitute an adequate diet (Onyeje, 2022). Consequently, they may resort to staples that are nutrient-deficient, which affect energy levels, physical stamina, mood, memory, mental clarity, emotional and mental well-being of children (Kamath, *et al.,* 2017). In addition to micronutrient deficiencies, intake of poorly diversified diet is frequently associated with poor nutritional and health outcomes in children (Frempong, *et al*., 2017; Faber, *et al*., 2016; Steyn, *et al*., 2006).

Evidence has shown that physical growth and cognitive development in children are faster during the early years of life, and that by the age of 4 years, 50% of the adult intellectual capacity has been attained, and 92% by age of 13years (Vernon, *et al.,* 2000). Therefore, under-nutrition at this early stage may have profound long lasting consequences on a child's cognitive function, behavior and health (de Onis & Branca, 2016) which may impact negatively on their academic performance (Eniyew, *et al*., 2019).

A child's nutritional status is most widely measured using anthropometric parameters such as height, weight, head circumference, among others (UNICEF, 2013). A child is diagnosed with under-nutrition when the child's height (stunted), weight (underweight), or weight-for-height (wasted) is well below the mean expected for age and sex on a standardized growth chart (WHO, 2021). Chronic under-nutrition during primary school age is one of the important causes of poor school enrolment, high absence from school, unsatisfactory educational achievement, early dropout and serious health impairments later in life that reduce the quality of life of individuals (Sathiadas, *et al.,* 2021; Eze *et al*., 2017).

Studies done in different parts of Africa have reported high prevalence of under-nutrition and low dietary diversity among children (Umeokonkwo *et al*., 2020; Ayogu *et al.,* 2018; Uzosike *et al.,* 2020; Patsa & Mukherjee, 2021; Tariku *et al.*, 2018; Modjadji *et al*., 2020). However, Predictors of dietary diversity and its association with Nutritional Status and Academic Performance of primary school children has not been reported in Anambra State and this motivated this study. Therefore, it is hoped that this study will achieve the following objectives: determine factors contributing to dietary diversity of primary school children in Anambra State; ascertain proportion of pupils who met the minimum dietary diversity (MDD) using a 72-hour dietary recall, determine relationship between dietary diversity and nutritional status; determine relationship between dietary diversity and academic performance; determine association between dietary diversity and parent's educational level; determine association between dietary diversity and family's average monthly income; and determine difference in dietary diversity between pupils in private and public primary schools.

Methodology

Study Design- Cross-sectional analytical survey
Area of Study-Anambra State, Southeast Nigeria
Population of study- Primary school pupils in rural and urban communities of Anambra State
Sample size- 650 pupils from selected private and public schools in Anambra State, who met the inclusion criteria
Sampling Techniques- multistage sampling technique
Stage 1: using a simple random sampling method, Anambra South senatorial district was selected out of the three senatorial zones namely Anambra North, Anambra South and Anambra Central.
Stage 2: the seven LGAs in Anambra South were stratified into rural and urban. Simple random sampling method was then used to select two LGAs- one rural (Ekwusigo) and one urban (Nnewi North), and each has four communities.
Stage 3: the researchers further used a simple random sampling technique to select two primary schools- one public and one private from each of the communities; making a total of 16 schools (8 public and 8 private) used in the study.
Stage 4: proportionate stratified sampling technique was used to determine the number of pupils to be selected from each school while random sampling by balloting without replacement was then used to select the pupils who participated in the study from each class.

Instruments for Data Collection

i. **Questionnaire:** A structured questionnaire was administered to pupils and parents in order to elicit relevant data required for the study.
ii. **Digital weighing scale:** A digital weighing scale with 180.00kg capacity (OMRON HN283) was used to obtain the weights of the participants.
iii. **Measuring tape**: A non-distensible plastic tape with 150.00cm capacity was used to measure the participants' heights with the child leaning against a wall and looking straight ahead (Frankfort position), ensuring that the legs are straight and touching together, arms are at the sides, and shoulders are level, to ensure uniformity
iv. **Checklist**: A 72-hour dietary recall checklist of 12 food groups proposed by Food and Agricultural Organization (Kennedy, *et al.,* 2013) was used to elicit dietary diversity score of the pupils. Dietary diversity scores (DDS) was calculated by summing up the points scored in each of the food groups, and classified as low (≤4), medium (5–8) and high (9–12).

v. **Result booklets**: Participants' result booklets were used to obtain average scores on all subjects taken by the pupils in the last academic session, i.e. first, second and third terms examination results (2022/2023 academic year).

Method of Data Collection

Permission to carry out the study was obtained from the State's Basic Education Board. More so, ethical approval was obtained from Ethics Committee, Nnamdi Azikiwe University Teaching Hospital, Nnewi, Anambra State. The researchers also obtained approval letters from the Local Government Education Authorities which were presented to heads of selected primary schools in order to obtain permission to carry out the study. Proper consent was sought from parents/guardians and assent from the pupils. Data was collected over a three month period. Participants' exact weights were measured while standing erect and facing forward without foot wears. Measurements were taken with the pupils on sports wears in order to minimize error due to different texture and weight of clothing. Before commencing each day, the weighing scale battery was checked (by looking the battery indicator) and replaced when necessary to ensure optimal functioning of the scale

Method of Data Analysis

The data was analyzed using Statistical Package for Social Sciences (SPSS) soft ware version 25 (IBM Corp., Armonk, New York, USA). Nutritional status calculated using the WHO AnthroPlus version 1.0.4. Descriptive statistics were used to summarize the socio-demographic data. Pearson chi square was used to determine the relationships between variables. Both crude and adjusted odds ratios (AORs) with their corresponding 95% CIs were used to determine the strength of association. Alpha significant level was set at 0.05 ($p<0.05$).

Results

Table 1: Socio-Demographic Characteristics of the Respondents

N= 637

Variables	Category	Freq	Percent (%)
Age (years)	6-9	361	56.67
	10-13	268	42.07
	>13	8	1.26
Sex	Male	297	46.60
	Female	340	53.40
pupil's place of residence	Urban	452	71.00
	Rural	185	29.00
Type of school	Private	393	61.70
	Public	244	38.30
Family size	1-3 persons	30	4.70
	4-6 persons	310	48.70
	7 and above	297	46.60

Type of family	Nuclear	426	66.90
	Extended	211	33.10
Mother's HLE	No formal education	31	4.90
	Primary education	152	23.90
	Secondary education	314	49.30
	Tertiary education	137	21.50
	No contribution to welfare	3	0.50
Mother's employment status	Unemployed	48	7.50
	Employed	587	92.2
	Deceased	2	0.30
Father's HLE	No formal education	44	6.90
	Primary education	189	29.70
	Secondary education	283	44.40
	Tertiary education	81	12.70
	No contribution to welfare	40	6.30
Father's employment status	Unemployed	5	0.80
	Employed	602	94.5
	Deceased	30	4.70
Family's ave. monthly income	Low (<30,000)	115	18.05
	Ave. (30,000-100,000)	331	51.96
	High (>100,000)	191	29.99
Parent's socioeconomic status	Low	221	34.70
	High	416	65.30

Most of the pupils 361 (56.67%) were between 6-9years, 268 (42.07%) falls within 10-13years while 8 (1.26%) were above 13years with a mean age of 9.22±1.98years. Majority were females (53.4%) while 46.6% were males. Considering the place of residence, a larger number of pupils 452 (71%) lived in urban areas whereas 185 (29%) were rural dwellers. Pupils attending private schools were in greater number (61.7%) compared to those attending public schools (38.3%). Also, majority of the pupils (95.3%) lived in families with at least four persons (2.42±0.58) compared to a few (4.7%) who came for families with less than four persons. Furthermore, larger number of pupils 426 (66.9%) came from nuclear families in contrast to 211 (33.1%) who were from extended families. The table further revealed that majority of the mothers (95.1%) had some form of education while a few (4.9%) had no formal education. In the same vein, most of the mothers (92.2%) had some form of occupation, only a few (7.5%) were unemployed. Similarly, most of the fathers had some form of education (86.8%) and occupation (94.5%), while a few received no formal education (6.9%) nor had any occupation (0.8%). More so, considering the family's average monthly income, 31.2% of the families earned between30,000-50,000 naira; 30.0% above 100,000 naira; 20.7% between 50,000-100,000 naira; while 18.1%

earned less than 30,000 naira. It was also observed that a larger number of the pupils (65.3%) were from high socioeconomic class compared to 34.7% who were from low class.

Objective 1: Factors contributing to dietary diversity of primary school children in Anambra State

Table 2

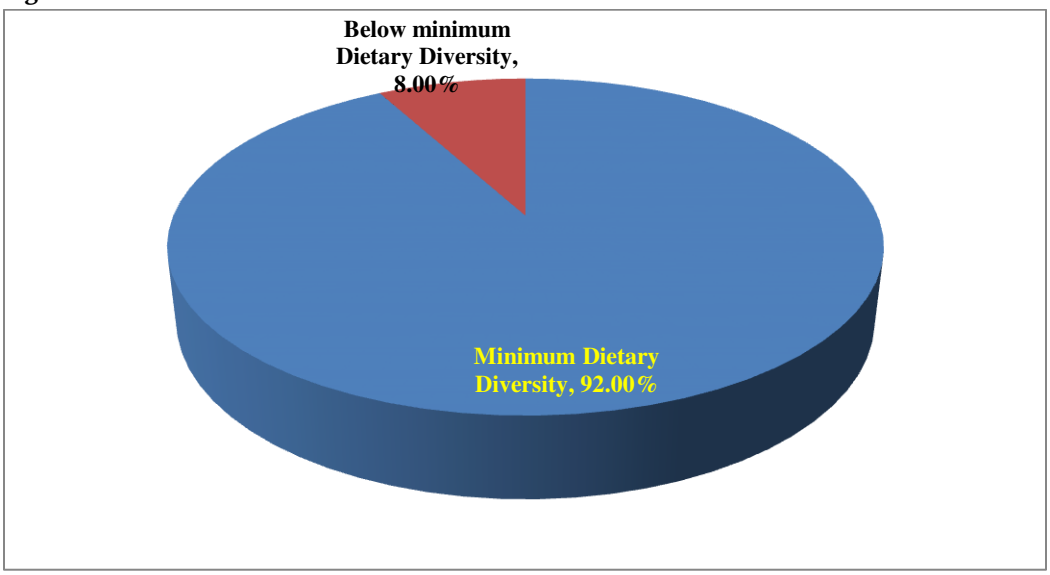
Covariates	Category	Percent(%)	COR (95%CI)	AOR (95% CI)	P value
Age	-	-	1.09 (0.99-1.19)	1.23 (1.10-1.37)	0.000**
Sex	Male	46.60	0.59 (0.41-0.84)	0.50 (0.34-0.75)	0.001**
	Female	53.40	1.00	1.00	
Place of residence	Urban	71.00	3.70 (2.54-5.38)	4.12 (2.62-6.49)	0.000**
	Rural	29.00	1.00	1.00	
Type of school	Private	61.70	2.48 (1.73-3.56)	2.25 (1.40-3.63)	0.001**
	Public	38.30	1.00	1.00	
Family size	1-3persons	4.70	0.51 (0.23-1.13)	0.42 (0.16-1.07)	0.070
	4-6persons	48.70	0.75 (0.52-1.08)	0.67 (0.44-1.03)	0.068
	7 and above	46.60	1.00	1.00	
Type of family	Nuclear	66.90	0.39 (0.25-0.59)	2.75 (1.71-4.42)	0.000**
	Extended	33.10	1.00	1.00	
Mother's HEL	No formal edu	5.02	1.00	1.00	
	Primary edu	24.02	1.25 (0.58-2.74)	1.36 (0.59-3.14)	0.472
	Secondary edu	49.45	1.94 (0.92-4.11)	1.27 (0.55-2.91)	0.575
	Tertiary edu	21.51	4.32 (1.91-0.71)	1.4 (0.50-3.94)	0.520
Father's HEL	No formal edu	13.19	1.00	1.00	
	Primary edu	29.67	1.61 (0.95-2.74)	1.31 (0.73-2.37)	0.365
	Secondary edu	44.43	2.42 (1.45-4.03)	1.06 (0.56-2.03)	0.851
	Tertiary edu	12.71	14.44(4.83-43.12)	4.25(1.21-14.97)	0.024**
Average monthly income	Low	18.05	1.00	1.00	
	Average	51.96	2.35 (1.52-3.63)	1.59 (0.86-2.92)	0.139
	High	29.99	8.30 (4.56-5.10)	1.91 (0.75-4.87)	0.176
Socioeconomic class	High	65.31	3.03 (2.10-4.36)	1.53 (0.83-2.82)	0.175
	Low	34.69	1.00	1.00	

In the binary logistic regression analysis shown in **table2** the odds of having a high dietary diversity score was higher with increasing age (AOR = 1.23, 95% CI: 1.10– 1.37, p=0.000); urban residence (AOR=4.12, 95% CI: 2.62- 6.49, p=0.000); attending private schools (AOR= 2.25, 95% CI: 1.40- 3.63, p= 0.001); belonging to a nuclear family (AOR= 2.75, 95% CI: 1.71- 4.42, p= 0.000); high socioeconomic status (AOR= 1.53, 95% CI: 0.83- 2.82, p= 0.175). Other factors that increased the likelihood of high dietary diversity include pupils whose

parents had formal education and families with good source of income. However, male gender (AOR=0.50, 95% CI: 0.34-0.75, p= 0.001) and increasing family size reduces the likelihood of high dietary diversity.

Objective 2: Ascertain proportion of pupils who met the minimum dietary diversity

Figure 1



The above chart shows that majority (92.0%) of the pupils met the minimum dietary diversity.

Objective 3: Relationship between dietary diversity and nutritional status

Table 3

		Dietary diversity class			
Nutritional indices	**category**	**Low**	**Medium**	**High**	**Total**
HFA z score	Normal	151	424	27	602
	Stunted	16	19	0	35
Total		**167**	**443**	**27**	**637**
Chi-Square (χ^2)= 8.18; df=2; p= 0.017**					
BMIFA z score	Normal	99	246	13	358
	Borderline	46	116	6	168
	Wasted	16	28	0	44
	Overweight	5	26	3	34
	Obesity	1	27	5	33
Total		**167**	**443**	**27**	**637**
Chi-Square (χ^2)=25.11; df=8; p= 0.001**					

The cross-tabulation above shows that 45.71% of stunted children had low dietary diversity while 54.29% and 0% had medium and high dietary diversity, respectively. Similarly, 36.36% of pupils who were wasted had low dietary diversity while none had high dietary diversity. The implication is that children with low dietary diversity are more likely to be stunted and/or wasted compared with their counterparts with medium or high

dietary diversity. The level of significance in the analysis indicates that dietary diversity is strongly associated with nutritional status.

Objective 4: Relationship between dietary diversity and academic performance

Table 4

		Dietary diversity class			
Variable	**Category**	**Low**	**Medium**	**High**	**Total**
Academic performance	**Poor performance**	39	88	5	132
	Average performance	62	145	8	215
	High performance	66	210	14	290
Total		**167**	**443**	**27**	**637**
Chi-Square (χ^2)=3.52; df=4; p= 0.475					

The above shows the distribution of pupils' academic performance in relation to their dietary diversity and it can be seen that of the pupils with poor academic performance, 29.55% had low dietary diversity, 66.67% medium dietary diversity while only 3.78% had high dietary diversity. In the same vein, 80.14% of pupils with medium dietary diversity had either average or high academic performance compared with 19.86% with low dietary diversity. Therefore, pupils with medium or high dietary diversity performed better academically. Although this relationship was not significant (p=0.475), implying that other factors may contribute to the academic performance of a child.

Objective 5: Determine association between dietary diversity and parent's educational level

Table 5

		Dietary diversity class			
Variable	**Category**	**Low**	**Medium**	**High**	**Total**
Mother's edu level	No formal edu	13	18	1	32
	Primary edu	54	96	3	153
	Secondary edu	82	224	9	315
	Tertiary edu	18	105	14	137
Total		**167**	**443**	**27**	**637**
Chi-Square (χ^2)=34.16; df=6; p= 0.000**					
Father's edu level	No formal edu	36	45	3	84
	Primary edu	60	126	3	189
	Secondary edu	67	201	15	283
	Tertiary edu	4	71	6	81
Total		**167**	**443**	**27**	**637**
Chi-Square (χ^2)=38.87; df=6; p= 0.000**					

Table 5 revealed that most of the pupils (71%) whose parents had secondary education were in medium dietary diversity category. Only about 3% of pupils whose parents had no formal education were in high dietary diversity class. It therefore implies that a strong positive association exists between pupil's dietary diversity and parent's educational level.

Objective 6: Determine association between dietary diversity score and family's average monthly income

Table 6

		Dietary diversity class			
Variable	**Category**	**Low**	**Medium**	**High**	**Total**
Family's monthly income	Low (<30,000)	55	60	0	115
	Average(30,000-100,000)	93	227	11	331
	High (>100,000)	19	156	16	191
Total		**167**	**443**	**27**	**637**

Chi-Square (χ^2)=62.53; df=4; p= 0.000**

The above table shows that majority of the pupils (81.7%) who belong to households with high monthly income had medium dietary diversity while 9.9% of them had low dietary diversity. This shows a significant association between dietary diversity and family's average monthly income.

Objective 7: Determine the difference in dietary diversity between pupils in private and public primary schools

Table 7

Variables	**Category**	**Type of school**		
		private	**Public**	**Total**
Dietary diversity class	Low dietary diversity	76	91	167
	Medium dietary diversity	295	148	443
	High dietary diversity	22	5	27
Total		**393**	**244**	**637**

Chi-Square (χ^2)=27.48; df=2; p= 0.000**

The cross-tabulation count indicates that out of 167 pupils with low dietary diversity score, majority 91 (54.5%) were pupils attending public schools. Also, those attending private schools 22 (81.5%) had high dietary diversity scores compared to five (18.5%) of their counterparts in public schools.

Discussion

Factors contributing to dietary diversity of primary school children in Anambra State

After adjusting for other variables, results from this study indicated that the odds of having higher dietary diversity score was significantly greater with increasing age (AOR = 1.23, 95% CI: 1.10– 1.37, p=0.000); urban residence (AOR=4.12, 95% CI: 2.62- 6.49, p=0.000); attending private schools (AOR= 2.25, 95% CI: 1.40-3.63, p= 0.001); and belonging to a nuclear family (AOR= 2.75, 95% CI: 1.71- 4.42, p= 0.000). Other factors that increased the likelihood of high dietary diversity include high socioeconomic status (AOR= 1.53, 95% CI: 0.83- 2.82, p= 0.175); pupils whose mothers (AOR= 1.4, 95% CI: 0.50- 3.94, p= 0.520) and fathers (AOR= 4.25, 95% CI: 1.21- 14.97, p= 0.024) had formal education and families with good source of income (AOR= 1.91, 95% CI: 0.75-4.87, p= 0.176). However, male gender (AOR=0.50, 95% CI: 0.34-0.75, p= 0.001) and increasing family size (AOR= 0.67, 95% CI: 0.44- 1.03, p= 0.068) reduces the likelihood of having a high dietary diversity.

This result is in tandem with the findings of Keno *et al.*, (2021), Dangura *et al.,* (2017), and Berhe *et al.,* (2017), who reported higher dietary diversity score with increasing age, caregivers with formal education and families with high income. This observation might be due to the fact that with increasing age children are more likely

to accept a variety of foods when offered to them; also better education and high income increases access to nutritional information and purchasing power of families. Similarly, Modjadji, *et al.,* (2020), Worku, *et al.,* (2022), Melaku *et al.,* (2018), Kumera, *et al.,* (2018), and Worku *et al.,* (2017) reported that low dietary diversity was associated with low socioeconomic status, government schools attendance, low household income and mothers with no formal education. This may be because lack of formal education and poverty reduces the capacity of mothers to make proper nutritional choices for the children and the family.

Proportion of pupils who met the minimum dietary diversity (MDD) using a 72-hour dietary recall

It can be deduced that most of the pupils (92.0%) consumed between four food groups and above, which is the WHO recommendation for optimal child growth. Only a small proportion of the pupils (8.0%) could not achieve a minimum dietary diversity. This observation seems commendable and may be attributed to a larger number of the pupils residing in the urban areas. However, Uzosike, *et al.,* (2020) reported a lower prevalence of MDD (56.0%) in Port Harcourt metropolis, Nigeria; Okafor *et al.,* (2020) reported a prevalence of 69.7% in Nsukka, Nigeria, while Keno, *et al.,* (2021) observed a very low prevalence of 17.2% in Chelia District, Ethiopia. These discrepancies may be attributed to differences in the characteristics of the populations studied and different dietary recall periods used as cited studies determined MDD using a 24-hour dietary recall.

Relationship between dietary diversity and nutritional status

Result analysis indicated that children with low dietary diversity are more likely to be stunted (p= 0.017) and/or wasted (p= 0.001) when compared with their counterparts with medium or high dietary diversity. This strong association between dietary diversity and nutritional status is understandably so because consumption of a variety of food from different food groups ensures adequate nutrition which is important in optimal growth and cognitive development of a child especially during the school age. Similar findings were reported by Mahfouz *et al.,* (2021) in rural Upper Egypt; Modjadji *et al*. (2020) in North West Province of South Africa; Sié *et al*., (2018) in rural Burkina Faso; and Okafor *et al.,* (2020) in a rural community in Nigeria, that higher dietary diversity score predicts better nutritional outcomes in children.

Relationship between dietary diversity and academic performance

The result revealed that pupils with medium or high dietary diversity had better academic performance when compared with their counterparts with low dietary diversity. Although this relationship was not significant (p=0.475), implying that other factors such as age, sex, type of school, residence, may contribute to the academic performance of a child. This result agrees with the study done by Bouchefra, *et al.,* (2023) who revealed that dietary diversity score is a significant predictor of academic performance (P value < 0.01) for French and Mathematics. Similarly, Okafor *et al.,* (2020) opined that dietary diversity was positively associated with academic performance. The disparities noted in these studies may be due to difference in methodology, while the index study utilized a 72-hour dietary recall to assess dietary diversity, the other studies used a 24-hour recall which may not reflect the usual dietary pattern in the family and so may be prone to more recall bias. Also the present study assessed academic performance using average scores of all twelve subjects taught in the immediate past academic session, whereas Bouchefra *te al.,* (2023) and Okafor *et al.,* (2020) only utilized two and four subjects, respectively, in their studies. Also different statistical analyses were performed in the different studies.

Determine association between dietary diversity and parent's educational level

Result revealed a strong positive relationship between dietary diversity and parent's educational level (p= 0.000). This is believably so, as parents with better education are more likely to have better occupation and more nutritional information which will result to better nutritional choices for their children. This finding

agrees with observations of Keno *et al.*, (2021), Worku, *et al.,* (2022) and Nowak *et al.,* (2016) who reported that mother's educational level is positively associated with dietary diversity of children.

Determine association between dietary diversity score and family's average monthly income

In our finding, majority of pupils who belonged to households with average or high monthly income had medium or high dietary diversity when compared to those from low income households. This association was very significant (p= 0.000) and goes to show that economic power predicts the quality and variety of food available for the household. This observation is consistent with the findings of Solomon *et al.,* (2017), Gonete, *et al.,* (2020) and Melaku, *et al.,* (2018), and Tamiru, *et al.,* (2016) who reported a positive association between family's income and dietary diversity of children.

Determine the difference in dietary diversity between pupils in private and public primary schools

Result of this study shows that majority of pupils attending private schools had medium or high dietary diversity scores when compared with those in public schools who had low dietary or at best medium dietary diversity (p= 0.000). The relationship between school type and dietary diversity could be because pupils attending private school were more likely to come from high socioeconomic background and therefore had better access to diversified foods, compared to those attending public schools that were likely from low social class and have limited access to food. This result concurs with reports of Worku, *et al.,* (2022) and Gali, *et al.,* (2017), who stated that attending government schools is associated with low dietary diversity in adolescents.

Conclusion

Majority of the study participants met the minimum dietary diversity score and factors such as age, place of residence, type of family, type of school, parent's educational level and household monthly income significantly impacted the dietary diversity of primary school pupils. Also, children with higher dietary diversity had better nutritional status and academic performance. Therefore, nutritional education to parents/guardians and teachers is crucial for them to better understand what constitutes an adequate meal and the need to take advantage of seasonal foods. Furthermore, since pupils whose parents had formal education and high average monthly income met the minimum dietary diversity, multiple measures to empower families should be adopted to improve family's income. Furthermore, since finding suggests that pupils in private schools had better dietary diversity than their counterparts in public schools, resuscitating the now moribund school feeding programme and expanding its coverage will go a long way in improving the nutrition of pupils in public schools.

Limitations of the Study

The study is not free of recall bias and social desirability bias. Dietary diversity scores could have been under or over estimated, since it is dependent on ability to recall accurately.

Acknowledgement

The authors are grateful to the Anambra State Universal Basic Education Board for the permission granted to conduct this study in public primary schools in Anambra State. We thank all teachers in the selected schools who assisted with coordinating the pupils during the data collection days.

Funding

This study did not receive any research grant.

References

1. Adedokun, S.T., and Yaya, S. (2021). Factors associated with adverse nutritional status of children in sub-Saharan Africa: Evidence from the Demographic and Health Surveys from 31 countries. Maternal & Child Nutrition, 17(3).
2. Adeomi, A.A., Fatusi, A. and Klipstein-Grobusch, K. (2022). Food Security, Dietary Diversity, Dietary Patterns and the Double Burden of Malnutrition among School-Aged Children and Adolescents in Two Nigerian States. Nutrients*, 14*(4):789.
3. Ashagidigbi, W.M., Ishola, T.M. and Omotayo, A.O. (2022). Gender and occupation of household head as major determinants of malnutrition among children in Nigeria. Scientific African, 16.
4. Asmare, B., Taddele, M., Berihun, S. Wagnew, F.(2018).Nutritional status and correlation with academic performance among primary school children, northwest Ethiopia. BMC Research Notes 11 (1)**:** 805.
5. Ayogu, R.N., Afiaenyi, I.C., Madukwe, E.U. and Udenta, E.A. (2018). Prevalence and predictors of under- nutrition among school children in a rural South-eastern Nigerian community : a cross sectional study. BMC Public Health, 18:587.
6. Bandoh, D.A. and Kenu, E. () Dietary diversity and nutritional adequacy of under-fives in a fishing community in the central region of Ghana. BMC Nutrition, 3(2).
7. Berhe, G., Gudina, E., and Assefa, N. (2017).Dietary diversity practice and associated factors among infants and young children in Haramaya town, Ethiopia. International Journal of Public Health Journal, 6(3):243–50
8. Bouchefra, S., El Ghouddany, S., Ouali, K., and Bour, A.(2023). Is good dietary diversity a predictor of academic success? Acta Biomedica 94(2):e2023014.
9. Dangura, D., and Gebremedhin, S., (2017). Dietary diversity and associated factors among children 6 to 23 months of age in Gorche district, southern Ethio- pia: cross-sectional study. BMC Pediatric.17(1):6
10. de Onis, M., and Branca, F. (2016). Childhood stunting: a global perspective. *Maternal & child nutrition 12*(Suppl 1):12–26.
11. Drammeh,W., Hamid, N.A., and Rohana, A.J. (2019). Determinants of Household Food Insecurity and its Association with Child Malnutrition in Sub-Saharan Africa: A Review of the Literature. Current Research in Nutrition and Food Science, 7(3):610-623.
12. Eniyew, T., Abebe, F., Gela, D., Asegid, A. and Tiruneh, D. (2019). Nutritional status among primary school students and its association on academic performance in north-central Ethiopia: Cross-sectional study design.Semantic scholar,
13. Eze, J.N., Oguonu, T., Ojinnaka, N.C. and Ibe, B.C. (2017). Physical growth and nutritional status assessment of school children in Enugu, Nigeria. Nigerian Journal of Clinical Practice 20(1): 64-70.
14. Faber, M., Laubscher, R. and Berti, C. (2016). Poor dietary diversity and low nutrient density of the complementary diet for 6-to 24-month-old children in urban and rural Kwa Zulu-Natal, South Africa. Maternal and Child Nutrition, 12: 528–545.
15. Febrianti, A.N., Susanto, T. and Rasni, H. (2022). Family Function and Nutritional Status among under-Five Children: A Cross- Sectional Study among Extended Family in Panti Public Health Center, Jember Regency of Indonesia. International Journal of Caring Sciences, 15(1):417-423.
16. Frempong, R.B., and Annim, S.K. (2017). Dietary diversity and child malnutrition in Ghana. Heliyon, 3(5): e00298

17. Gali, N., Tamiru, D., and Tamrat, M. (2017). The emerging nutritional problems of school adolescents: Overweight/obesity and associated factors in Jimma Town, Ethiopia. Journal of Pediatric Nursing, 35: 98–104. Elsevier Inc.
18. Gonete, K.A., Tariku, A., Wami, S.D., and Akalu, T.Y.(2017). Dietary diversity practice and associated factors among adolescent girls in Dembia district, northwest Ethiopia. Public Health Rev.41:23.
19. Hailegebriel, T. (2020). Prevalence and determinants of stunting and thinness/wasting among schoolchildren of Ethiopia: a systematic review and meta-analysis. Food Nutrition Bulletin 41(4): 474–493.
20. Kamath, S.M., Venkatappa, K.G. and Sparshadeep, E.M. (2017). Impact of nutritional status on cognition in institutionalized orphans: A pilot study. Journal of Clinical and Diagnostic Research, 11(3):CC01-CC04.
21. Kennedy, G., Ballard, T., and Dop, M. (2013). Guidelines for measuring household and individual dietary diversity. Rome: Food and Agriculture Organization of the United Nations. ISBN 978-92-5-106749-9.
22. Keno, S., Bikila, H., Shibiru, T., and Etafa, W. (2021). Dietary diversity and associated factors among children aged 6 to 23 months in Chelia District, Ethiopia. *BMC Pediatrics 21*(1):565.
23. Khamis, A.G., Mwanri, A.W., Ntwenya, J.E., and Kreppel, K. (2019). The influence of dietary diversity on the nutritional status of children between 6 and 23 months of age in Tanzania. BMC Pediatrics, 19(1):518.
24. Kumera, G., Tsedal, E., and Ayana, M. (2018). Dietary diversity and associated factors among children of Orthodox Christian mothers/caregivers during the fasting season in Dejen District, North West Ethiopia. Nutrition and Metabolism (Lond),15(16).
25. Melaku, Y., Dirar, A., Feyissa, G.T., and Tamiru, D., (2018). Optimal dietary practices and nutritional knowledge of school adolescent girls in Jimma Town, South West Ethiopia. International Journal of Adolescence and Youth, 23(3):1-9.
26. Modjadji, P. Molokwane, D. and Ukegbu, P.O. (2020). Dietary Diversity and Nutritional Status of Preschool Children in North West Province, South Africa: A Cross Sectional Study. Children (Basel),7(10):174.
27. Moursi, M.M., Arimond, M., Dewey, K.G., Treche, S., Ruel, M.T., and Delpeuch, F. (2008).Dietary diversity is a good predictor of the micronutrient density of the diet of 6-to 23-month-old children in Madagascar. Journal of Nutrition, 138: 2448–2453.
28. Nowak, A.Z., and GANGADHAR, D.(2016). The contribution of education to economic growth: Evidence from Nepal. International Journal of Economic Sciences,vol (2), pp. 22-41.
29. Ogbonnaya, R.O., Ogidan, S., Adebayo, T., Edeh, S., Ogbodo-Iwuagwu, P., Ilozue, C., Faturoti G. and Oyeniran A. (2020). School Feeding Programme: Searching For Beneficiaries of N186 Billion Food. INDEPENDENT,
30. Ogunode, N.J. and Abubakar, M.(2021). National Home Grown School Feeding Programme (NHGSFP) in Nigeria: Achievement, Problems of Implementation and way forward. Pindus Journal of Culture, Literature, and ELT,*8*: 25-32.
31. Okafor, A.M., Odo, E.O., and Onodigbo, E.O. (2020). Dietary diversity: association with academic performance and anthropometric indices of rural Nigerian school children. Pakistan Journal of Nutrition, 19: 61-67.
32. Onyedika-Ugoeze, N. (2018, February 8). 'Only 39.4% primary school age children currently enrolled'. TheGuardian.

33. Onyeje, B. T. (2022). Micronutrient deficiency among Nigerian population: the hidden hunger. International Academic Journal of Medical and Clinical Practice, 7(2): 1-14.
34. Patsa, M.K. and Mukherjee, S.S. (2021). Relationship between Nutritional Status and Academic Performance of Primary School Children in Rural Bankura Region of West Bengal, India. Bioscience Biotechnology Research Communications, 14(2): 686-691.
35. Sathiadas, G., Antonyrajan, A., Arunath, V. and Thangaraja, K. (2021). Nutritional status of school children living in Northern part of Sri Lanka. *BMC Pediatrics 21*(1).
36. Sharma, M., Watode, B. and Srivastava, A. (2017). Nutritional status of primary school children through Anthropometric Assessment in rural areas of Moradabad. Annals of International Medical and dental research 3(2):
37. Sié, A., Tapsoba, C., Dah, C., Ouermi, L., Zabre, P., Bärnighausen, T., Arzika, A.M., Lebas, E., Snyder, B.M., Moe, C., Keenan, J.D., and Oldenburg, C.E. (2018). Dietary diversity and nutritional status among children in rural Burkina Faso. International journal, 10(3):157-162.
38. Soekatri, M.Y.E., Sandjaja, S., and Syauqy, A (2020). Stunting Was Associated with Reported Morbidity, Parental Education and Socioeconomic Status in 0.5-12-Year-Old Indonesian Children. International Journal of Environmental Research and Public Health, 17(17):6204.
39. Soheilipour, F., Salehiniya, H., Farajpour.kh, M. and Pishgahroudsari, M.(2019). Breakfast habits, nutritional status and their relationship with academic performance in elementary school students of Tehran, Iran. Medicine and Pharmacy Reports, 92 (1): 52-58.
40. Soto, C. J., and Tackett, J. L. (2015). Personality traits in childhood and adolescence: structure, development, and outcomes. Current Directions in Psychological Sciences, 24 (5): 358–362.
41. Steyn, N., Nel, J., Nantel, G., Kennedy, G. and Labadarios, D. (2006). Food Variety and Dietary Diversity Scores in Children: Are they Good Indicators of Dietary Adequacy? Public Health Nutrition, 9: 644–650.
42. Tamiru, D., Argaw, A., Gerbaba, M., Nigussie, A., Ayana, G., and Belachew, T. (2016). Improving dietary diversity of school adolescents through school based nutrition education and home gardening in Jimma Zone: Quasi-experimental design. *Eating Behaviors*, *23*:180–186.
43. Tariku, E.Z., Abebe G.A., Melketsedik, Z.A., and Gutema, B.T. (2018) Prevalence and factors associated with stunting and thinness among school-age children in Arba Minch Health and Demographic Surveillance Site, Southern Ethiopia. *PLoS ONE 13*(11).
44. Ugochukwu, E., Onubogu, C., Edokwe, E., and Okeke, K. (2014). Nutritional contents of lunch packs of primary school children in nnewi, Nigeria. Annal of Medicine and Health Science Research,4(Suppl 2):S108-14.
45. Umeokonkwo, A.A., Ibekwe, M.U., Umeokonkwo, C.D., Okike, C.O., Ezeanosike, O.B. and Ibe, B.C. (2020). Nutritional status of school age children in Abakaliki metropolis, Ebonyi State, Nigeria. BMC Pediatrics, 20 (114).
46. United Nations International Children Education Fund, UNICEF (2013). *Improving child nutrition: the achievable imperative for global progress*. [E-VERSION] New York: UNICEF.
47. Uzosike, T.C.J. Okeafor, I. and Mezie-Okoye, M. (2020). Dietary Diversity, Nutritional status and Academic performance of pupils in public primary schools in Port Harcourt Metropolis. Journal of Community Medicine and Primary Health Care 32 (2):45-56.
48. Vernon, P.A., Wickett, J.C., Bazana, P.G., and Stelmack, R.M. (2000). *The neuropsychology and psychophysiology of human intelligence*. In: Sterberg RJ, editors. Handbook of intelligence. Cambridge University Press, New York.

49. Wolde, M., Berhan, Y. and Chala, A. (2015). Determinants of underweight, stunting and wasting among school children. BMC Public Health, 15(1):1-9.
50. Worku, M., Hailemicael, G. and Wondmu, A.(2017). Dietary diversity score and associated factors among high school adolescent girls in Gurage Zone, Southwest Ethiopia. World Journal of Nutrition and Health, 5: 41–45
51. Worku, L., Mamo, K., Bekele, T., and Atlaw, D.(2022). Dietary diversity score and associated factors among high school adolescent girls in a selected school of Yeka Sub-city, Addis Ababa. SAGE Open Medicine, *10*:.