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Dietary Diversity as a Correlate of Undernutrition Among School-Age Children in Southwestern Nigeria

M. F. Olumakaiye, PhD

Please note that this study was published before the SY2014-15 implementation of the Smart Snacks Nutrition Standards for Competitive Food in Schools, as required by the Healthy, Hunger-Free Kids Acts of 2010. As such, certain research relating to food in schools may not be relevant today.

ABSTRACT

Purpose/Objectives

This study was conducted to determine the association between undernutrition and dietary diversity among school-age children in southwestern Nigeria.

Methods

A total of 600 school children were randomly selected from six private and six public schools in the region. A standardized FAO-published 24-hour diet recall questionnaire for calculating a dietary diversity score was adapted, tested, and used for all students. Weight and height measures were taken and weight-for-age, height-for-age, and weight-for-height Z scores were calculated to determine the prevalence of underweight, stunting, and wasting respectively.

Results

The average age for students in the study was 8.3 years. Significant differences existed between students in private and public schools in BMI-for-age (p = .025), in dietary diversity scores (p = .034) and in undernutrition (p = .003). No private school children exhibited underweight or stunting, but 11.7% were overweight or obese. No public school students were overweight. Stunting (p = .024) and wasting (p = .018) correlated significantly with lower dietary diversity scores. The food groups at the lowest levels in the children's diet were organ meats, milk and milk products, eggs, and vitamin A rich fruits and vegetables.

Applications to Child Nutrition Professionals

A dietary diversity score may be useful in identifying school children at risk of undernutrition and the food groups most often lacking in local diets. Methods of increasing dietary diversity in meals at school and at home are likely to benefit children at nutritional risk.

INTRODUCTION

Child malnutrition is the most widely spread disorder in Sub-Saharan Africa (Food and Agriculture Organization (FAO) of the United Nations, 2006; United Nations Children's Fund (UNICEF), 2007). Malnutrition has been recognized and known to cause a great deal of both physical and emotional human suffering, while it is viewed as a violation of a child's human right to both health and food (Macharia, Kogi-Makan, & Muroki, 2005). The nutritional status of school children is of particular concern, since the early years of life are crucial for optimal growth and development. Undernutrition, specifically wasting and stunting, has been recorded in Burkina Faso (Dabone, Delisle, & Receveur, 2011) and Seychelles (Bovet, Kizirian, Madeleine, Blossner, & Chiolero, 2011); stunting has been reported in Limpopo (Threon, Amssah, Kleyhans, Albertse, & MacIntyre, 2007) and South Africa (Oldewage-Threon & Egal, 2010). Stunting has been recorded to affect one-third of children in developing countries (UNICEF, 2007).

Nutrition is a major factor affecting children's overall development and learning (Florence, Asbridge, & Veugelers, 2008; Ijarotimi & Ijadunola, 2007; Kris-Etherton, 2004; Singr, 2004). Poorly nourished

children have more problems fighting infections. Therefore, they may be sick, miss school more often, and fail to keep up academically with classmates (Brooker et al., 2006). For the purpose of this study, malnourished children were identified by using the definition of WHO Global Database on Child Growth and Malnutrition, which uses a Z-score cut-off point of < -2 SD to classify low weight-for-age, low height-for-age, and low weight-for-height as moderate and severe undernutrition, and < -3 SD to define severe undernutrition.

According to the UNICEF conceptual framework on malnutrition, inadequate dietary intake is an immediate cause of malnutrition (UNICEF, 1990). Generally, school lunch programs, which provide free and reduced-priced meals for children in schools, are required to provide one third of the Recommended Dietary Allowances (RDA) at lunch, to help ensure that children eating in schools consume adequate amounts of nutrients that are of public health importance, such as protein, iron and vitamins A and C (American Dietetic Association, 2010). RDAs are the amount of nutrients considered adequate to meet the known nutrient needs of healthy people (Francis & Klitzke, 2010). In the study area, the state government is involved in the home grown school feeding program, which provides lunch for children in public, primary schools up to grade three (Ogunba, Ogbimi, Soyebo, & Olumakaiye, 2007).

Studies have shown that an increase in individual dietary diversity score is related to increased nutrient adequacy in diets, such as found in Bangladesh (Arimond, Torheim, Wiesmann, Joseph, & Carriquiry, 2009), Mozambique (Wiesmann, Arimond, & Loechi, 2009), and Philippine (Daniels, 2009). Consumption of a poor diet over a long period of time leads to malnutrition (FAO, 2006; Thiam, Samba, & Lwanga, 2006). Protein-energy malnutrition has been a common health problem in developing countries, especially among school-age children who are deprived of good and ample nutrition (Dabone et al., 2011).

Therefore, in order to empirically determine that a less diverse diet is associated with poor growth, measures of nutritional status and dietary diversity in both public and private school age children in a region of Nigeria were assessed. The association of dietary diversity with measures of undernutrition was then analyzed.

METHODOLOGY

Study Area and Sampling

The study was carried out in Ile-Ife Local Government Area of Osun State, in the southwest geopolitical zone of Nigeria. It is situated on longitude 4°56'E and latitude 7°29'N.

A multistage random sampling technique was used to select the schools that were included in the study. The zone was divided into three regions and the primary schools in each region were stratified into private and public schools. Two schools each were randomly selected from both public and private schools per region by ballot, resulting in a total of six private schools and six public schools. The schools that operated boarding house systems were excluded from the survey.

The multistage random sampling technique was also used to select the students. The sample size was divided among the schools using a simple percentage. Total number of students in each school was determined and about ten percent of the students were selected from each school. Finally, classrooms were chosen on a systematic random basis, and one out of five school children were selected randomly from a classroom using the school register. A total of 625 school children were interviewed, but only data from 600 school children were included for data analyses after removal of outliers because of incomplete responses.

Research Instruments

Data for the study were collected using an interview schedule, which contained the children's characteristics, anthropometry, and dietary diversity measures.

Child's characteristics elicited were sex and date of birth, which was later used to determine age. The interview schedule was translated to the local language for those who were not fluent in the spoken English language, and was later translated back for easy analysis. The respondents were

school children who were within the age range of 6–11 years. Field workers were trained to ask the questions and fill out the questionnaires on behalf of the school children.

Anthropometry
Weight and height measurements were obtained from all the participants. Weight was recorded using a digital Jorita floor bathroom balance. Weights were taken using the standard procedure, which was recorded to the nearest kilogram.

A locally adapted height measuring board (Stadiometer) was used for the height measurement (Cogill, 2003). Height was measured using standard procedures and was recorded to the nearest centimeter. The measurements were repeated, and mean values were recorded and used for the analyses.

Z-scores of Body mass index for age (BMI-for-age) were used to determine the nutritional status while weight-for-age (WAZ), height-for-age (HAZ) and weight-for height (WHZ) Z-scores (< -2 SD from the mean) were calculated to identify the prevalence rates of underweight, stunting, and wasting respectively (Centers for Disease Control and Prevention, 2011; De Onis et al., 2007).

Dietary Diversity
A standardized dietary diversity questionnaire from FANTA Household Dietary Diversity Score Indicator Guide (FAO, 2010) was adapted to calculate the Dietary Diversity Score (DDS) of the school children (Swindale & Bilinsky, 2006). The questionnaire is composed of sixteen food groups; food items that were peculiar to the study area were added to the list of foods per group while foreign food items were removed from the list. The school children were asked all they ate in the preceding 24 hours (24-hour dietary recall). Foods eaten in school and at home as breakfast, mid-morning snacks, lunch, afternoon snacks, and dinner were probed. The children in grades one through three in the public, primary schools investigated were fed in school through the state school feeding program, while the children from private schools went to school with their lunch packed from home. The DDS was a simple count of food groups that the children consumed, with the purpose of reflecting nutrient adequacy. An increase in DDS is related to increased nutrient adequacy of the diet (Kennedy, Ballard, & Dop, 2011; Kennedy, Pedro, Seghieri, Nantel, & Brouwer, 2007; Ruel, Graham, Murphy, & Allen, 2004; Steyn, Nel, Nantel, Keneddy, & Labadarios, 2006).
Validity and Reliability of Research Instrument
Overall content validity was carried out to ensure that the questionnaire collected and measured the information required within the framework of the research objectives. The test-retest reliability method was used to determine the reliability. The questionnaire was tested in a separate population of 20 students not in the study area. Two weeks later, the same questionnaire was administered, and the results compared. The coefficient of 0.72 was obtained, hence showing content validity of the questionnaire. Faults that were detected were corrected before carrying out the research in the target population.
Data Analyses
Nutrisurvey nutritional software was used to analyze the nutritional status of the school children. Data was entered and processed using SPSS version 16.0 (Statistical Package for the Social Sciences, Chicago, IL, USA) software for analysis involving descriptive and inferential statistical methods. Data was disaggregated into private and public primary school students. The frequency of occurrence and percentages of the various parameters were presented in tables. T-test analysis was used to examine difference; likewise correlation analysis was conducted to determine the relationships. All inferences were made at a significance level of $p < .05$.
Ethical Issues
The University Research Committee, through the Department of Family, Nutrition and Consumer Sciences of Obafemi Awolowo University, Ile Ife, Nigeria, approved the study. Ethical clearance was obtained from the State Ministry of Education before visiting the schools, and consent papers were signed by the parents of the selected children. The children themselves also agreed orally to participate in the study.

RESULTS AND DISCUSSION

Child Characteristics

Data in Table 1 showed that there were 310 (51.7%) boys and 290 (48.3%) girls who participated in the study, with more boys (56.7%) in public schools than private schools (46.7%) (p = .181). The mean age was 8.28 years ± 1.44, which was significantly higher in public (9.12) than private schools (7.43) (p = .000). There were more children within the age range 6–8 years in private school (93.3%), and more in the 9–11 year range in public (68.3%) (Table 1).

Table 1. *Personal Characteristics of Students Attending Private and Public Schools*

Variables	Private School *n* = 300 Frequency (%)	Public School *n* = 300 Frequency (%)	Total Sample *N* = 600 Frequency (%)	*p*
Sex				
Male	140 (46.7)	170 (56.7)	310 (51.7)	
Female	160 (53.3)	130 (43.3)	290 (48.3)	.181
Age				
Mean ± SD	7.43 ± 0.81	9.12 ± 1.44	8.28 ± 1.44	
6-8 years	280 (93.3)	95 (31.7)	375 (62.5)	
9-11	20 (6.7)	205 (68.3)	225 (37.5)	.000
Weight (kg)				
Mean ± SD	27.73 ± 5.85	23.57 ± 3.70	25.65 ± 5.31	
≤ 20	30 (10.0)	80 (26.7)	110 (18.3)	
21-30	225 (75.0)	215 (71.7)	440 (73.3)	
31-40	30 (10.0)	5 (1.6)	35 (5.8)	.036
>40	15 (5.0)	0 (0.0)	15 (2.5)	
Height (m)				
Mean ± SD	1.31 ± 0.95	1.23 ± 0.81	1.28 ± 0.95	
≤1.30	155 (51.7)	245 (81.7)	400 (66.7)	
>1.30	145 (48.3)	55 (18.3)	200 (33.3)	.209
Nutritional Status				
Underweight (WAZ)	0	70 (23.3)	70 (11.7)	
Stunting (HAZ)	0	30 (10.0)	30 (5.0)	

Table 1. *Personal Characteristics of Students Attending Private and Public Schools*				
Wasting (WHZ)	10 (3.3)	15 (5.0)	25 (4.2)	.003
Normal	255 (85.0)	185 (61.7)	440 (73.3)	
Overweight/Obese	35 (11.7)	0	35 (5.8)	

Anthropometry Variables and Nutritional Status

There was a significant difference in the body weight of the children (p = .036). The mean body weight of the subjects was 25.65 kg ± 5.31, and mean weight was significantly higher in students in private schools (27.73 kg) than in public schools (23.57 kg) (Table 1). No significant differences were found in height. Weight, height, and age were used to calculate the BMI-for-age (Table 2).

Table 2. *Body Mass Index for Age*

	Private				Public			
Age (yrs)	Male	Mean BMI-for-age	Female	Mean BMI-for-age	Male	Mean BMI-for-age	Female	Mean BMI-for-age
6	23	16.1	33	15.2	15	11.6	8	13.2
7	34	16.8	28	15.7	23	13.4	33	14.2
8	74	18.1	88	16.3	5	13.7	11	16.1
9	3	22.6	5	21.0	44	16.1	38	16.2
10	3	21.4	3	22.5	55	18.8	40	19.3
11	3	23.4	3	25.2	28	22.1	-	-
Total	140	19.7	160	19.3	170	15.9	130	15.8

[a]Mean BMI-for-age for the private school students = 17.7 kg/m2

[b]Mean BMI-for-age for the public school students = 15.6kg/m2

Note. p = .025

The results of BMI-for-age Z-score at < -2 indicated that a public school student was likely to have significantly less body fat than a private school student. Underweight (WAZ) was recorded for 23.3% of public school students (over 20% is considered severe malnutrition by the WHO), 10.0% were stunted, and 5.0% had wasting, both considered low levels of malnutrition (WHO, 2012). Overweight/obesity (> 85th and > 95th percentile) was recorded only among the private school students (11.7%), and these students did not exhibit any underweight or stunting. Overall, a significant difference existed in the measures of nutritional status of private and public school children (p = .003) (Table 1).

Dietary Diversity

The food groups consumed by the school children as identified by the survey are reflected in Table 3.

Table 3. *Dietary Diversity of the Students Attending Private and Public Schools*

Food group	Private School *n* = 300 Frequency (%)	Public School *n* = 300 Frequency (%)	Total Sample *N* = 600 Frequency (%)	*p*
Cereals	300 (100.0)	300 (100.0)	600 (100.0)	0.624
White roots and Tubers	292 (97.3)	300 (100.0)	592 (98.7)	0.441
Vitamin A rich vegetables/tuber	97 (32.3)	23 (7.7)	120 (20.0)	0.033*
Dark green leafy vegetables	151 (50.3)	146 (48.7)	297 (49.5)	0.271
Other vegetables	300 (100.0)	300 (100)	600 (100.0)	0.624
Vitamin A rich Fruits	86 (28.7)	23 (7.7)	109 (18.1)	0.025*
Other fruits	76 (25.3)	69 (23.0)	145 (24.2)	0.456
Organ meats	24 (8.0)	2 (0.7)	26 (4.3)	0.031*
Flesh meats	136 (45.3)	124 (41.3)	260 (43.3)	0.501
Eggs	58 (19.3)	12 (4.0)	70 (11.7)	0.003*
Fish/sea foods	178 (59.3)	154 (51.3)	332 (55.3)	0.421
Legumes, nuts and seeds	257 (85.7)	286 (95.3)	543 (90.5)	0.337
Milk/milk products	57 (19.0)	12 (4.0)	69 (11.5)	0.040*
Oils/fats	249 (83.0)	244 (81.3)	493 (82.2)	0.611
Red palm product	249 (83.0)	258 (86.0)	507 (84.5)	0.532
Sweets	143 (47.7)	123 (41.0)	266 (44.3)	0.461
Spices/condiments	278 (92.7)	282 (94.0)	560 (93.3)	0.554

*Significant at $p < .05$

Overall, organ meats, milk/milk products, eggs, and vitamin A rich fruits and vegetables/tubers were the groups least consumed by the students. Significant differences were found for all of these groups between the two student groups, with private school students reporting a higher consumption of eggs ($p = .003$), vitamin A rich fruits ($p = .025$), organ meat ($p = .031$), vitamin A rich vegetables/tubers ($p = .033$), and milk ($p = .040$). (Table 3).

The overall results of the dietary diversity score (DDS) are shown in Table 4, with scale ratings of low (DDS = 7), moderate (DDS = 8-10), and high (DDS < 10).

Table 4. *Level of Dietary Diversity by School Type*

Variables	Private School *n* = 300 Frequency (%)	Public School *n* = 300 Frequency (%)	Total Sample *N* = 600 Frequency (%)	*p*
Dietary Diversity Score Low (=7)	50 (16.7)	105 (35.0)	155 (25.8)	
Moderate (8 – 10)	160 (53.3)	140 (46.7)	300 (50.0)	
High (>10)	90 (30.0)	55 (18.3)	145 (24.2)	.034*
Mean ± SD	9.02 ± 1.73	8.27 ± 1.41	8.73 ± 1.64	

*Significant at $p < .05$

Dietary diversity was categorized into sixteen food groups, with a total mean score of 8.73 ± 1.64, which was higher among private (9.02 ± 1.73) than public school children (8.27 ± 1.41) (p = .034). More private school students (30%) than public (18.3%) were rated high, while 35.0% of the public school students were rated low compared to 16.7% private school students rated low. These results imply that children in private schools tend to have a more adequate food intake in terms of varieties than their counterparts in public schools.

Association between Undernutrition and Dietary Diversity

A significant association was found between undernutrition and dietary diversity in this cross-sectional study. Low dietary diversity was significantly and strongly associated with stunting (p = .024) and wasting (p = .018) while moderate dietary diversity was significantly associated with wasting (p = .041). High dietary diversity had an inverse association with undernutrition (Table 5).

Table 5. *Cross Tabulation Showing Association Between Undernutrition and Dietary Diversity*

	Dietary Diversity					
	Low Frequency (%)	*p*	Moderate Frequency (%)	*p*	High Frequency (%)	*p*
Underweight (WAZ)	35 (50.0)	0.880	25 (35.7)	0.543	10 (14.3)	0.734
Stunting (HAZ)	8 (26.7)	0.024*	20 (66.7)	0.442	02 (6.6)	0.833
Wasting (WHZ)	15 (60.0)	0.018*	5 (20.0)	0.041*	5 (20.0)	0.812

*Significant at $p < .05$

This study indicated a considerable level of undernutrition among school-age children in southwestern Nigeria; underweight was 11.7%, stunting was 5.0%, and wasting was 4.2%, which was particularly higher in public school children.

Underweight was the most prevalent type of malnutrition among the school children in the study area, followed by stunting, then wasting. The conditions of wasting and stunting were found to be

elevated among children in public school, whereas no cases of stunting were found in private schools. Wasting did exist among both groups, though higher in public. These results differ from the situation in Burkina Faso, where wasting was recorded among 13.7% of students and 3.4% were stunted (Dabone et al., 2011). Wasting was also recorded in Seychelles (Bovet et al., 2011) and stunting was recorded in Limpopo and South Africa (Threon et al., 2007). According to UNICEF (2007), stunting affects one-third of children in developing countries.

The prevalence of wasting (low weight for height) among the school children in this study could be due to acute problems such as infection/diseases as well as more acute malnutrition; stunting (low height for age) might be a result of early malnutrition, which could be associated with dietary diversity as found in this study. The low dietary diversity of the children is a reflection of ongoing family food insecurity in the study area. If children are stunted yet still at a low weight for that lower height, there would definitely be an underweight problem. In this study, underweight was not associated with dietary diversity, unlike the other measures; this could be as a result of an overall lack of food to meet energy needs, which might not necessarily be identified by the DDS.

Overweight/obesity is gradually increasing all over the world with 20 developing counties already reporting rates of more than 5% (UNICEF, 2007). This is also the case among the study sample, with 5.8% of the total sample classified as overweight/obese; it is important to note that overweight/obesity was found only in the private school children. This is in corroboration with South Africa where overweight and obesity were prevalent among 10% and 4% respectively of all children between ages one and nine years (Lin et al., 2007).

Both undernutrition and overnutrition co-existed in the study sample population, with overnutrition among private school children and undernutrition among public school children. This is in agreement with Labadarios et al. (2005); Oninla, Owa, Onayade, and Taiwo (2007); and Wenhold, Kruger, and Muehlhof (2008), who reported that increasing numbers of young people are faced with multiple malnutrition problems, such as insufficient, excessive, or imbalanced nutrient intakes.

The data in this current study revealed lower dietary diversity among the public school children and higher dietary diversity among the private school children. Vitamin A rich foods and animal proteins were the least consumed by both groups.

Low dietary diversity was significantly associated with undernutrition. A similar study in South Africa indicated that rural children who were stunted had mean energy intakes less than RDA standards (Oldewage-Threon & Egal, 2010; Threon et al., 2007) and in Zambia, low nutrient intake (Hautvast et al., 1998) . According to Kleynhans, MacIntyre, and Albertse (2006), households with non-stunted children spent more money monthly on protein foods, adequate energy, and other varieties of food than did households with stunted children.

The current study adds to others that emphasize dietary diversity in addition to total energy intake as a key factor in nutritional well-being for children. A lack of a sufficient supply of energy-dense foods for growth and energy needs, and reliable access to key food groups such as animal products and fruits/vegetables with needed micronutrients, increases the risk of negative effects on children's development, health, and learning.

CONCLUSIONS AND APPLICATION

Empirical evidence from this study demonstrates that malnutrition existed in the study area among school children. Undernutrition (wasting, stunting, and underweight) was more prevalent among the children in public schools, while overnutrition (overweight/obesity) was found only in private school students. Children who had low DDSs were more undernourished than children with higher DDSs.

The prevalence of undernutrition is a concern, especially among children in public schools. There is a dearth of information on the prevalence of undernutrition among school-age children, and most of the available data on children's nutritional status is for children under five years. Children's weights should continue to be recorded after 5 years of age and during attendance at school.

There is no single approach to tackling nutritional issues in school children. However, as found in this study, schools are a powerful, potentially supportive setting. More varieties of food should be introduced into ongoing school meal programs in the study area as a long term strategic approach to ensure at least a provision of nutritionally balanced meals for all children each day.

The school lunch program is an important part of the public school system. Children often rely on school lunch as part of a nutritious, healthful diet. School lunch programs have a long history of providing nutrition for school-aged children, but today there is a growing concern about the quality of the food they provide. School meals are intended as free meals for children who have challenges obtaining adequate nutrition. For some students, the school lunch is the only real meal they get each day; therefore, adequate provision should be made to ensure that varieties of food are provided for dietary diversity (Bundy, 2005). Among the students whose parents can afford a meal at home, but might not have the time and knowledge to prepare a healthy meal for their children, school lunch may also play an important role.

Vitamin A rich foods and nutrient-rich animal proteins, including eggs and milk/milk products, should be increased in the school meals generally in the study area and particularly in public schools. School meal programs have the potential of being an important access point for key food groups found less frequently in local children's diets. Additionally, parents and family members should be empowered by creating awareness about the importance of good nutrition and food variety for the optimum development of their growing children.

Improved nutrition through dietary diversity is critical to children's well-being. The challenge of providing students with nutritious lunches often falls on the schools, which may not have the resources to meet the demands placed on them. Today many schools are seeking better ways to meet this challenge, and the best solution will vary from school to school. Parents may assist by learning about local challenges, helping to find solutions, and setting a good example of healthful eating at home, while teaching children how to choose nutritious food.

Nutrition educators, school administrators, and teachers have a role to play in ensuring dietary diversity by educating the children on the importance of eating a variety of healthful foods, incorporating nutrition into the school curriculum, and establishing nutrition clubs for the school children. Policymakers also have a stake, and have an important leadership role in formulating sustainable policies that ensure the delivery of nutritious meals to assist school children in achieving their full potential.

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BIOGRAPHY

Olumakaiye is a Senior Lecturer at the Department of Family, Nutrition and Consumer Sciences, Faculty of Agriculture, Obafemi Awolowo University, Ile Ife, Nigeria.