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Prevalence, pattern and factors associated with undernutrition among Primary school aged children in Rivers State Nigeria

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Abstract

Background: Undernutrition among children contributes to the high diseases burden in Nigeria and other developing countries undergoing nutritional transition. It presents as underweight, stunting and thinness/wasting.
Objective: This study looked at the pattern of undernutrition among primary school aged children in Rivers State.
Materials and Methods: This is a cross-sectional descriptive study among primary school-aged children in Rivers State Nigeria recruited through a multistage sampling method. Information on socio-demography, dietary habit and physical activity of the pupils were obtained from parents who gave informed consent while weight and height measurements were carried out directly on assenting pupils. Data was analyzed using IBM SPSS Statistics version 23 and WHO Anthroplus software. Results were presented in frequency table. Test of statistical significance was done at $P < 0.05$
Results: A total of 465 pupils aged 5 – 13 years participated in the study. Mean age was 8.64 ± 0.113 years.
Twenty-nine (6.2%) of the pupils were stunted, 8 (1.7%) were severely stunted; 19 (4.1%) were thin/wasted and 18 (3.9%) were severely thin/wasted; 12 (3.1%) were under-weight and 4 (1.0%) were severely underweight. Stunting and underweight were associated with type of school, place of residence, class of pupils, occupation and level of education of parents ($P < 0.05$); thinness/wasting was associated with only birth order ($P < 0.05$). Undernutrition was not associated with physical activity and dietary habit.
Conclusion: Stunting was the commonest pattern of undernutrition among primary school age children in Rivers State Nigeria followed by underweight and thinness/wasting.

Keywords: stunting, underweight, thinness, wasting, undernutrition, Rivers State.

Introduction

The attainment of healthy nutritional status is key to maintenance of good health and the realization of Sustainable Development Goals. Children undergo intense physical growth and development and attain approximately 20% of adult height as well as 50% of adult weight and body mass during the school age period.[1-4] Nigeria like other developing countries is undergoing a nutritional transition and both undernutrition and overnutrition are prevalent. This increases her burden of diseases and the demand on healthcare services provision. Abnormalities in nutritional statuses in infancy and childhood have been linked to poor cognitive development and academic performance in the short term.[5,6] It has also

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been associated with faulty mental, social, physical, and national economic developments as well as the development of other chronic disease conditions like hypertension, diabetes, obstetric complications, etc. in adulthood in the long term.[1,3,7-11]

Undernutrition may arise from nutritional lack which may be due to unavailability of good quality food, poor dietary habits and recurrent childhood infection which increases the body's demand for nutrients.[9,12,13] It presents as underweight, stunting and thinness/wasting and can be determined using anthropometric measures of weight and height appropriate for the child's age and sex.[5,8] This method, which is non-invasive, cheap, and acceptable for the assessment of nutritional status uses international standard cut -off points.[14] The WHO 2007 growth reference and CDC growth monitoring charts uses the less than 5th percentile or Z scores of less than - 2SD of the median weight or height-for-age and sex as threshold for defining undernutrition.[2]

Whereas stunting which measures nutritional lack over a long period of time is defined as a height-for-age below -2SD of Z-score of children median height, wasting or thinness which measures nutritional lack over a short period of time, is defined as a weight-for-height below -2SD of Z score of children median weight for height ratio while underweight is measured as weight-for-age below -2 SD of Z score of the children median weight for age and sex.[2,8] Underweight measures both acute and chronic nutrient insufficiency because a child could be underweight due to short stature (chronic lack) or thinness (acute lack).

Over 200 million children of school age worldwide are either stunted or underweight and these account for an estimated 2.2 million annual deaths.[9] In Nigeria, undernutrition is still a public health problem,[3] and no appreciable improvement has been reported recently. For instance, in the Nigeria Demographic and Health Survey (NDHS) 2008, 23% of children 6 – 59 months were underweight, 40.6% were stunted and 13.9% were wasted/thin, ten years later the NDHS 2018 showed that 22%, 37% and 7% of children aged 6 – 59 months were underweight, stunted and wasted respectively.[2,13,15]

Undernutrition has also been reportedly high in parts of Nigeria, for instance studies in Abakiliki metropolis Ebonyi State reported that 27.3% and 17.1% of primary school aged children were underweighted and stunted respectively while in rural communities in Kainji Dam it was found that 21.5% of pupils were stunted, 35.2% were thin/wasted and 16.9% were underweight.[2,8] Other studies in Nigeria have reported differences in undernutrition among children based on their place of residence (urban/rural), sex, age, and type of school (public/private).[1,12,16]

International and national concerns and research on childhood nutrition has concentrated on the under-fives and to the exclusion of children aged five -19 years despite the nutritional sensitivity of this stage of physical development and its impacts on later life.[10] Undernutrition among primary school aged children has not been well documented in studies on childhood nutrition in Rivers State.[15] Therefore this study seeks to assess the prevalence, patterns and factors associated with undernutrition among primary school aged children in Rivers State, Nigeria. It is hoped that the findings from this study will be useful in documenting the existence of undernutrition among primary school aged children in Rivers State Nigeria, increase its awareness as a nutritional challenge of primary school-aged children in Rivers State Nigeria and also to assist governments, private organizations and advocacy groups develop nutritional programs to improve on the nutritional status of school children.

Methods

Study area

This study was conducted between January 20 and February 4, 2016, in Rivers State situated in the Niger Delta region of Nigeria. The State is comprised of three urban and twenty rural Local Government Areas (LGAs) with a projected population of 6.2million people.[18] The major occupation of the people is traditional farming, fishing and petty trading in the rural areas. However commercial and industrial activities which provide employment opportunities also thrive in the urban areas due to the presence of oil exploration and exploitation activities in the State. The system of education in Rivers State is the Universal Basic Education (UBE). Pupils go through Basic 1 - 6 classes to complete their primary education. There are 935 public primary schools and 258 government approved private primary schools in the State

supervised by the Rivers State Ministry of Education.[17]

Study design and Sampling

A cross-sectional descriptive study design was adopted in this study. This was carried out among school children aged 5-13 years attending primary schools in Rivers State Nigeria. Sample size was calculated using the Cochran formula $n = Z^2pq/d^2$ where n = minimum sample size; Z = Z score corresponding to 95% level of statistical significance = 1.96; p = estimated proportion of attribute based on previous studies. Prevalence rates of wasting (35.2%), stunting (21.5%) and underweight (16.9%) in a similar study were used to calculate the minimum sample size. However, the prevalence rate of wasting (35.2%) which gave the highest sample size was adopted thus p = 0.352; q = 1-p = 0.648 and d = Precision/tolerable error (5%) = 0.05.8 Minimum sample size was determined as 351. However, to accommodate for 25% non-response this was increased to 470. A multistage sampling method was used in selecting the participants. Stage 1: selection of three LGAs in the State (one urban and two rural); Stage 2: selection of five schools in each selected LGA (two public and three private schools per LGA); Stage 3: selection of 31 pupils in each selected school. Simple random sampling method was used to select a proportionate sample of pupils from the classes in the school. Consequently, a total of fifteen primary schools out of 1193 in the State and 465 pupils participated in the study. Exclusion criteria included pupils who were ill or have limb deformities and could not stand properly, and those who had attained sexual maturity or had chronic disabilities which may likely affect their weight eg sickle cell disease.

Data collection

A pretested self-administered structured survey questionnaire was used to collect information on the demography, physical activity, and dietary history of participants as well as socioeconomic status of their parents or guardians. A data sheet was used to collect information on weight and height from 465 assenting participants whose parents or guardian gave informed consents.

The weighing scale (Model ZT-120) graduated from zero to 120kg was used to measure the weight of pupils. These measurements were taken before their lunch break. The pupils wore light clothing (school uniform) but without footwears and pullover. Weights were measured to the nearest 0.1kg. To ensure the accuracy of the weighing scale, a standard 5kg weight was used to recalibrate the scale before measurement of the pupils. Measurement of height of pupils was done using a stadiometer mounted on the weighing scale (Model ZT-120). Pupils were made to stand barefooted on the footplate of the weighing scale with their arms hanging freely on both sides and palms facing the thighs and the buttocks but ensuring that their heels and back of the head were making direct contact with the stadiometer. Height was recorded to the nearest millimeter (1mm) during maximal inspiration by lowering the headboard to the apex of the pupil's head in Frankfort's plane (a line perpendicular to the metric rule on the wall, passing through the participant's cheek and opening of the external ear). Where necessary, the hair on the pupil's head was flattened to ensure accuracy of height measurement.[17]

Data analysis

Statistical analysis of outcome variables was done using IBM SPSS Statistics version 23. However, the WHO AnthroPlus software was used for the calculation of anthropometric indices: weight-for-age (underweight for ages 5 – 10 years), height-for age (stunting) and BMI-for-age (thinness/wasting). Results were presented in frequency table and percentages. Chi square test was done to test statistical significance in bivariant analysis at $P < 0.05$

Outcome variables

1. Undernutrition was determined using the WHO 2007 growth reference as stunting: height-for-age score (HAZ score) < −2SD; Underweight: weight-for-age score (WAZ score) < −2SD or Thin/wasting: body mass index-for-age score (BAZ score) < −2SD.[8]

2. Dietary habit was determined as healthy, if pupils ate three main meals (breakfast, lunch and dinner) daily, each consisting of at least two of the main food groups (carbohydrates and vegetables; meat and alternatives; fats and oil) per day and also ate snacks (soft drink, canned fruit drinks, ice

creams, biscuits, chocholates and sweets, cakes, meat pies, doughnuts and other fastfoods) not more than twice a week; or unhealthy, if they ate more or less than three main meal per day or ate snacks more than twice a week.[11,19]

3. Physical activity was determined using a composite activity score (CAS) on a scale of 1 – 5 points, derived from participant's responses to a set of twelve questions on physical activity and seven on sedentary activity. Participants with composite scores of 4 points and above meet the CDC recommendation on physical activity and were thus classified as physically active while those who scored less than 4 points were classified as physically inactive.[20]

Ethical approval

Ethical clearance was obtained from the Research Ethics Review Committee of the University of Port Harcourt Teaching Hospital, Port Harcourt. Permission to collect data in the selected primary schools were granted by Rivers State Ministry of Education, LGA Education Units and the Headmasters or Headmistresses to the selected schools. Parents or guardians of participants gave informed consent following detailed information on the purpose of the study and an assurance of safety as well as the confidentiality of their information. The pupils however assented to participate in the study.

Results

Four hundred and sixty-five primary school aged children whose mean age was 8.64 ± 0.113 years participated in this study. Males were slightly more (n = 245; 52.7%) and majority of the respondents were in primary 4 (n = 98; 21.1%). Table 1a. Approximately half of the pupils live in rural areas (n = 234; 50.3%) and attend public schools (n = 235; 50.5%). Nearly all of the pupils were physically inactive (n = 453; 97.3%) while about two-third had unhealthy dietary habit (n = 306; 65.8%). Table 1b. Majority of their mothers (n = 183;39.4%) and fathers (n = 193; 41.5%) had tertiary education. Petty trading (n = 138; 29.6%) and self-employment (n = 135; 29.0%) were the commonest occupation among the mothers and self-employment (n = 195; 43.0%) among the fathers. (Table 2).

A total of 29 (6.2%) pupils aged 5 - 13 years were stunted, 8 (1.7%) of these were severely stunted. Similarly, 19 (4.1%) had wasting and 18 (3.9%) of them were severely thin/wasted. Furthermore, 12 (3.1%) of pupils aged 5 – 10 years were underweight generally, out of these 4 (1.0%) were severely underweight. (Table 3). More of the males than females were stunted (n = 17; 6.9%), underweight (n = 7; 3.5%) and wasted/thin (n = 10; 4.1%) however, there was no statistically significant association between sex of pupils and stunting (P = 0.568), underweight (P = 0.694) and wasting/thinness (P = 0.996). Undernutrition was most prevalent among children who are 5 years old.

Table 1a: Sociodemographic characteristics of respondents

Variables	Frequency	Percent
Sex (n = 465)		
Male	245	52.7
Female	220	47.3
Class of pupil (n = 465)		
Primary 1	80	17.2
Primary 2	75	16.1
Primary 3	81	17.4
Primary 4	98	21.1
Primary 5	84	18.1
Primary 6	47	10.1
Age (mean = 8.64; SD = 0.113) (n = 465)		
5	19	4.1
6	56	12.0
7	62	13.3
8	89	19.1
9	83	17.8
10	72	15.5
11	43	9.3
12	34	7.3
13	7	1.5

Table 1b: Sociodemographic characteristics of respondents (continued)

Variables	Frequency (n=465)	Percent
Type of school		
Public	235	50.5
Private	230	49.5
Place of residence		
Rural	234	50.3
Urban	231	49.7
Physical activity		
Active	12	2.6
Inactive	453	97.3
Dietary habit		
Healthy	159	34.2
Unhealthy	306	65.8

Table 2: Level of education and occupation of parents of the respondents

Variables	Frequency	Percent
Mother's level of education (n = 465)		
None	36	7.7
Primary	68	14.6
Secondary	178	38.3
Tertiary	183	39.4
Father's level of education (n = 465)		
None	46	9.9
Primary	38	8.2
Secondary	188	40.4
Tertiary	193	41.5
Mother's occupation (n = 465)		
Petty trading	138	29.6
Farming	49	10.5
Fishing	5	1.1
Unemployed eg Housewife	48	10.3
Professionals eg Doctor, Lawyer, Engineer, teacher	90	19.5
Self employed	135	29.0
Father's occupation (n = 453)		
Petty trading	54	11.9
Farming	43	9.5
Fishing	22	4.9
Unemployed	10	2.2
Professionals eg Doctor, Lawyer, Engineer, teacher	129	28.5
Self employed	195	43.0

Table 3: Prevalence and pattern of undernutrition among primary school aged children

Variables	Frequency	Percent (%)
Stunting (HAZ score) n = 465		
Normal (Z > -2 SD)	436	93.8
Stunted (Z < -2 SD)	21	4.5
Severely stunted (Z < -3SD)	8	1.7
Thinness/Wasting (BMIZ score) n=465		
Normal (Z > -2 SD)	446	95.9
Thinness (Z < -2 SD)	1	0.2
Severe thinness (Z < -3SD)	18	3.9
Underweight (WAZ score) *n=381		
Normal (Z > -2 SD)	369	96.9
Underweight (Z < -2SD)	8	2.1
Severely underweight (Z < -3SD)	4	1.0

*Children 5-10 yrs

Three (15.8%) were stunted, 3 (15.8%) underweight, and 2 (10.5%) thin/wasted. Stunting was also prevalent among children aged 12 years (n = 5; 14.7%) and thinness/wasting among those who are 11 years (n = 3; 7.0%). There was a statistically significant association between age of pupils and underweight (P = 0.031) but not with stunting (P =0.654) and thinness/wasting (P = 0.818). Pupils in primary one had more stunting (n = 13; 16.3%), underweight (n = 10, 12.5%) and thinness/wasting (n = 5; 6.3%) compared to those in the other classes. Class of pupil also showed a statistically significant association with stunting (P = 0.034) and underweight (P = 0.0007) but not with thinness/wasting (P = 0.658). Table 4a

Table 4b shows that undernutrition among primary school children was more prevalent in public schools compared to private schools. In the public schools, 26 (11.1%) pupils were stunted compared to 3 (1.3%) in private schools (P <0.0001); 10 (6.0%) pupils were under-weight in public schools compared to 2 (0.9%) in private schools (P = 0.005) and 12 (5.1%) pupils were thin/wasted in public schools compared to 7 (3.0%) in private schools (P = 0.261). First born children were most stunted (n = 12; 10.0%) and thin/wasted (n = 10; 8.3%) whereas the second born children were most underweight (n = 5; 5.5%). There were statistically significant association between birth order of pupils and stunting (P = 0.047) and thinness/wasting (P = 0.028) but not with underweight (P = 0.081). Undernutrition was also more prevalent among primary school aged children residing in rural areas compared to those in urban area. In the rural areas 25 (10.7%) of the pupils were stunted, 11 (5.7%) were underweight and 10 (4.3%) were thin/wasted. There were statistically significant association between place of residence and stunting (P < 0.0001), underweight (P = 0.004) but not with thinness/wasting (P = 0.837).

Stunting was more prevalent among pupils whose mothers had primary school education (n = 10; 14.7%; P = 0.0004) and those whose father had no education (n = 10; 21.7%; P < 0.0001). Similarly underweight was more prevalent among pupils whose mothers had primary school education (n = 7; 14.0%; P = 0.0017) and fathers with no education (n = 5, 17.9%; P < 0.0001). Furthermore, thinness/wasting was more prevalent among pupils whose mothers had primary school education (n = 4;

Table 4a: Stunting, underweight, and wasting among primary school aged children in Rivers State Nigeria and socio-demographic characteristics of respondents

Variable	Total	Stunted (%) n = 29	X^2 test (*P* val)	Total	Underweight (%) *n = 12	X^2 test (*P* val)	Total	Thin (%) n = 19	X^2 test (*P* val)
Sex									
Male	245	17 (6.9)	0.437	201	7 (3.5)	0.155	245	10 (4.1)	<0.001
Female	220	12 (5.5)	(0.568)	180	5 (2.8)	(0.694)	220	9 (4.1)	(0.996)
Age of child									
5	19	3 (15.8)		19	3 (15.8)		19	2 (10.5)	
6	56	6 (10.7)		56	4 (7.1)		56	0 (0)	
7	62	0 (0)		62	0(0)		62	2 (3.2)	
8	89	4 (4.5)		89	1 (1.1)		89	6 (6.7)	
9	83	2 (2.4)		83	2 (2.4)		83	1 (1.2)	
10	72	5 (6.9)	0.201	72	2 (2.8)	4.67	72	4 (5.6)	0.053
11	43	4 (9.3)	(0.654)	NA	-	(0.031)§	43	3 (7.0)	(0.818)
12	34	5 (14.7)		NA	-		34	1 (2.9)	
13	7	0 (0)		NA	-		7	0 (0)	
Class of pupil									
Primary 1	80	13 (16.3)		80	10 (12.5)		80	5 (6.3)	
Primary 2	75	3 (4.0)		75	0 (0)		75	3 (4.0)	
Primary 3	81	3 (3.7)		71	1 (1.4)		81	1 (1.2)	
Primary 4	98	2 (2.0)	4.51	83	0 (0)		98	5 (5.1)	0.196
Primary 5	84	4 (4.8)	(0.034)§	60	0 (0)	11.61	84	3 (3.6)	(0.658)
Primary 6	47	4 (8.5)		12	1 (8.3)	(0.0007)§	47	2 (4.3)	

*Calculated for ages 5 – 10 years (n = 381); § statistically significant

Table 4b: Stunting, underweight, and wasting among primary school aged children in Rivers State and socio-demographic characteristics of respondents (continued)

Variable	Total	Stunted (%) n=29	X^2 test (*P* val)	Total	Underweight (%) *n = 12	X^2 test (*P* val)	Total	Thinness (%) n = 19	X^2 test (*P* val)
Type of school									
Public	235	26 (11.1)	18.933	168	10 (6.0)	7.739	235	12(5.1)	1.262
Private	230	3 (1.3)	(<0.0001)§	213	2 (0.9)	(0.005)§	230	7 (3.0)	(0.261)
Birth order									
1	120	12 (10.0)		97	4 (4.1)		120	10 (8.3)	
2	114	8 (7.0)		91	5 (5.5)		112	4 (3.6)	
3	105	4 (3.8)		90	2 (2.2)		105	2 (1.9)	
4	50	3 (6.0)	3.94	43	1 (2.3)	3.047	50	2 (4.0)	4.81
5	33	0 (0)	(0.047)§	29	0 (0)	(0.081)	35	0 (0)	(0.028)§
6	43	2 (4.7)		31	0 (0)		43	1 (2.3)	
Place of residence									
Rural	234	25 (10.7)	15.931	193	11(5.7)	8.337	234	10 (4.3)	0.42
Urban	231	4 (1.7)	(<0.0001) §	188	1 (0.5)	(0.004) §	231	9 (3.9)	(0.837)

5.9%; P = 0.142) and fathers with no education (n = 4; 8.7%; P = 0.099). There were statistically significant association between the occupation of parent's and undernutrition. Stunting was more prevalent among pupils whose parents were farmers; mothers (n = 10; 20.4%; P = 0.00008) and fathers (n = 13; 30.2%; P = 0.0029); Underweight was also more prevalent among pupils whose parents were farmers; mothers (n = 7; 17.5%; P = 0.012) and fathers (n = 7; 20.0%; P = 0.033). However, thinness/wasting was more prevalent among mother's whose occupation was farming (n = 5; 10.2%; P = 0.267) and fathers were unemployed (n = 1; 10.0%; P = 0.588) Table 5.

Table 5: Stunting, underweight, and wasting among primary school aged children in Rivers State and occupation and level of education of parents of the respondents

Variables	Total	Stunted (%) n = 29	X^2 test (*P* val)	Total	Underweight (%)* n = 12	X^2 test (*P* val)	Total	Thinness (%) n=19	X^2 test (*P* val)
Mother's level of education									
None	36	5 (13.9)		22	1 (4.5)		36	2 (5.6)	
Primary	68	10 (14.7)		50	7 (14.0)		68	4 (5.9)	
Secondary	178	11 (6.2)	16.91 (0.0004)§	138	2 (1.4)	9.89 (0.0017) §	178	9 (5.1)	2.16 (0.142)
Tertiary	183	3 (1.6)		171	2 (1.2)		183	4 (2.2)	
Father's level of education									
None	46	10 (21.7)		32	5 (15.6)		46	4 (8.7)	
Primary	38	7 (18.4)	32.74	26	4 (15.4)	25.8	38	3 (7.9)	2.71
Secondary	188	9 (4.8)	(<0.0001)	150	2 (1.3)	(<0.0001)	188	5 (2.7)	(0.099)
Tertiary	193	3 (1.6)	§	173	1 (0.6)	§	193	7 (3.6)	
Mother's occupation									
Petty trading	135	12 (8.9)		97	3 (3.1)		135	5 (3.7)	
Farming	49	10 (20.4)		40	7 (17.5)		49	5 (10.2)	
Fishing	8	0 (0)		3	0 (0)		8	0 (0)	
Unemployed eg Housewife	48	4 (8.3)	15.47 (0.00008)	41	1 (2.4)	6.29 (<0.012) §	48	3 (6.3)	1.23 (0.267)
Professionals	90	2 (2.2)	§	84	1(1.2)		90	3 (3.3)	
Self employed	135	1 (0.7)		116	0 (0)		135	3 (2.2)	
Father's occupation									
Petty trading	54	2 (3.7)		45	0 (0)		54	2 (3.7)	
Farming	43	13 (30.2)		35	7 (20.0)		43	4 (9.3)	
Fishing	22	2 (9.1)		13	0 (0)		22	0 (0)	
Unemployed	22	0 (0)		13	0 (0)		22	1 (10.0)	
Professionals	129	2 (1.6)	8.88	115	2 (1.7)	4.52	129	5 (3.9)	0.293
Self employed	195	10 (5.1)	(0.0029) §	160	3 (1.9)	(0.033) §	195	7 (3.6)	(0.588)

*Calculated for ages 5 – 10 years (n = 381); § statistically significant

Table 6: Stunting, underweight, wasting among primary school aged children in Rivers State Nigeria and dietary habit and physical activity of respondents

Variable	Total n = 465	Stunted (%) n=29	X^2 test (*P* val)	Total (n=465)	Underweight (%)* n = 12	X^2 test (*P* val)	Total (n=465)	Thinness (%) n=19	X^2 test (*P* val)
Physical activity									
Active	12	0 (0)	0.819	11	0 (0)	0.368	12	1 (8.3)	0.567
Inactive	453	29 (6.4)	(0.365)	370	12 (3.2)	(0.544)	453	18 (4.0)	(0.451)
Dietary habit									
Healthy	159	9 (5.7)	0.137	122	2 (1.6)	1.342	159	9 (5.7)	1.528
Unhealthy	306	20 (6.5)	(0.711)	259	10 (3.9)	(0.247)	306	10 (3.3)	(0.216)

*Calculated for ages 5 – 10 years (n = 381)

Table 6 shows that undernutrition was prevalent among primary school aged children who were physically inactive. Among all the children who were physically active, only one (8.3%) was thin/wasted while none was stunted or underweight whereas among those who were physically inactive 29 (6.4%) were stunted (P = 0.365); 12 (3.2%) were underweight (P = 0.544) and 18 (4.0%) were thin/wasted (P = 0.451). Undernutrition was also more prevalent among primary school children with unhealthy dietary habit. Twenty (6.5%) of these pupils were stunted (P = 0.711), 10 (3.9%) were underweight (P = 0.247) and 10 (3.3%) were thin/wasted (P = 0.216)

Discussion

Although countries of the world are making concerted efforts towards reducing their burden of malnutrition to realize the SDG goals, undernutrition still remains a public health problem globally and particularly in Low- and Middle-Income countries (LMICs) like Nigeria. Unlike the preschoolers, the school aged children who require adequate nutrition for physical growth and development, are oftentimes ignored in nutritional programs and studies on childhood nutrition even though they are survivors of high under-five morbidity and mortality.[10,12,21] This study was done among primary school children aged 5 -13 years with mean age of 8.4 ±0.11 years in Rivers State Nigeria. In this study, 4.5% of these children were stunted and 1.7% were severely stunted; furthermore, 0.2% were thin/wasted and 3.9% were severely thin/wasted while 2.1% of the children aged 5 - 10 years were underweight and 1.0% severely underweight. This finding shows that the commonest form of undernutrition among school aged children in Rivers State Nigeria is stunting or chronic undernutrition. The implication of this finding among this subpopulation is in its effect on their physical growth and stature in adulthood. The development of short stature of the girl child in adulthood has been reported to be associated with obstetric complications and poor pregnancy outcomes.[8,12] This pattern of undernutrition has been reported in other studies in parts of Nigeria and other LMICs. However, the burden of undernutrition in our population is far better than those reported in several other studies. For instance, in a study carried out in Gombe and Osun States in Nigeria it was reported that 34.9% of children and adolescents were stunted, 13.5% were underweight and 10.3% were thin/wasted.[3] Similarly, in Jos North Nigeria it was reported that 26% of primary school aged children were stunted and 18.66% severely stunted while in South-eastern Nigeria, 41.6% of the rural children were found to be stunted, 20.0% were thin/wasted and 18.2% were underweight.[14,21]

Although the predominant form of undernutrition among school children in Enugu Nigeria was wasting/thinness, its burden compared to the finding in our study, was higher with prevalence rate of 9.3% while the prevalence of underweight (0.9%) and stunting (0.4%) were lower.[1] This observed difference in prevalence of wasting may be due to differences in sociocultural factors which could influence the feeding habits and nutrition of the school aged child. Elsewhere in the Volta region of Ghana, 26% of school age children were found to be stunted, 16% were underweight and 8% were thin/wasted.[22] Furthermore, in Ethiopia the prevalence of stunting, underweight, and wasting/thinness were respectively reported as 21.3%, 18.2% and 17.7%.[9]

Our study shows that undernutrition is more prevalent in the rural areas than in the urban and that place of residence was associated with stunting ($P < 0.0001$), underweight ($P = 0.004$) but not with thinness/wasting ($P = 0.837$). Similarly, undernutrition was more prevalent in the public schools than private school with a statistically significant association between type of school and stunting ($P < 0.0001$), underweight ($P = 0.005$) but not with thinness/wasting ($P = 0.261$). Studies carried out in Nigeria and elsewhere also reported that underweight and stunting were more prevalent in rural areas and in public schools.[2,12,21,23-25] These findings may result from the low socioeconomic status of families in rural areas, and this determines the availability of foods that meets the nutritional needs of their school children. These families who can only afford education for their children in public schools are more in the rural areas.[8] Sex has been reported as an independent determinant of undernutrition.[8,9] Our study found undernutrition to be more prevalent among males however, there was no statistically significant association between sex and stunting ($P = 0.568$), underweight ($P = 0.694$) and thinness/wasting ($P = 0.996$). However, that males were more stunted and thinner compared to females could probably be from the fact that boys are more involved in physical activities which deplete their energy unlike the girls who are more times at home and are more likely to have greater access to foods.[8,9]

Both underweight and stunting but not thinness/wasting were statistically associated with class of pupils with children in primary one being more undernourished compared to those in senior classes. Approximately 16%, 13% and 6% of children in primary one were stunted, underweight and thin/wasted respectively. The higher burden of undernutrition among these early school children

compared to the older school ones may be related to their age and that they are yet to recover from the developmental challenges of the preschool age or simply because they are yet to adapt to the new school environment. Chronic undernutrition (Stunting) was more prevalent at ages 5 years (15.8%), 6 years (10.7%) and 12 years (14.7%) whereas underweight (15.8%) and thinness/wasting (10.5%) were more prevalent at 5 years only. The high prevalence of undernutrition in these ages may suggest malnutrition in preschool periods and food insecurity arising from possibly economic and food crisis in the families.[1] Again, majority of children who are stunted, underweight or thin/wasted have mothers and fathers with only primary school education and are involved in peasant farming as source of income. Peasant farming, fishing and artisan occupations are low income generating activities common among the low socioeconomic class. This study also found stunting and underweight more prevalent among children with unhealthy dietary habits. This finding may further suggest that these parents who are of low socioeconomic status and have low level education, lack the requisite knowledge on nutrition and the preparation of available staple foods to ensure that their children have access to quality nutrition. Moreso, they are also likely to sacrifice the care of their school aged children for their peasantry.[9] These may further explain the observed higher prevalence of undernutrition among this rural school aged children.

Furthermore, all the children stunted and underweight were physically inactive. Perhaps this may be due to the prevailing insecurity in the region or that they simply lacked the energy required to participate in energy sapping physical activities. A study reported that low muscle mass in undernutrition influences oxygen uptake and therefore the strength and performance of physical exercise among school aged children. The reduced muscle mass associated with chronic and mild-to-moderate undernutrition influences the strength, performance, physical working capacity at a heart rate of 170 beats per minute (PWC170) and oxygen uptake (VO2max) in samples of school-aged children.[26]

The findings in this study is limited to in-school children in Rivers State only as participation in the study excluded children not enrolled in the primary schools. Its interpretation is likely to be affected by recall bias arising from memory recall of information provided by the guardian/parents of participant. Furthermore, information on family income obtained, were unreliable perhaps due to prevailing social insecurity in the area. Consequently, it was not analyzed. We believe that the current economic reality in Nigeria is worse than it was few years ago when this study was done and that the findings of this study fills in the missing gap in the trends of nutritional status of primary school-aged children in Rivers State.

Undernutrition is still prevalent among primary school aged children in Rivers State Nigeria with stunting (chronic undernutrition) being the commonest form of its presentation. It is more prevalent in public schools, rural areas and among children in primary one, ages 5 and 6 years, physically inactive and those with unhealthy dietary habits. Children aged 5 -13 years who are stunted and severely stunted were 4.5% and 1.75% respectively; those who were thin/wasted and severely thin/wasted were 0.2% and 3.9% respectively those who are underweight and severely underweight were 2.1% and 1.0% respectively. A statistically significant association was found between place of residence, type of school, age and class of pupils, level of education and occupation of both parents and stunting as well as with underweight ($P<0.05$).

Nutritional programs by governments and private organization should target school aged children who are survivors of the mortality and morbidity in preschool period. These programs should emphasize the teaching of healthy dietary habits in addition to such interventions as free school meals especially in public schools and in rural areas. Economic empowerment programs to support and improve small scale farming and businesses should be carried out by governments to increase the financial capacities of families especially in the rural areas. Adult education programs should be organized by government and non-governmental agencies to improve literacy level of families.

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