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COMPARATIVE STUDY OF ANTHROPOMETRIC INDICES OF NUTRITIONAL STATUS OF PUBLIC PRIMARY SCHOOL PUPILS IN RURAL AND URBAN COMMUNITIES OF WARRI SOUTH

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ABSTRACT

Background: *The application of anthropometric measurement which entails assessing the nutritional status (stunting, wasting, obesity, overweight, and underweight) of children, is an essential part of monitoring the health of a community.*

Aim: *To investigate and compare the anthropometric indices of nutritional status among public school pupils in rural and urban communities in Warri South LGA.*

Materials and Method: *This comparative cross-sectional study made use of a pretested interviewer-administered questionnaire while the nutritional status of the pupils was obtained using WHO AnthroPlus software. The resulting data were analysed and presented accordingly.*

Results: *The result showed that there were slightly more males (50.9%) than females (49.1%), while urban pupils were younger than their rural counterparts. Also, the mean scores for the weight, WAZ, Height, HAZ and BAZ were 26.67±5.77, -0.96±1.49, 1.32±0.10, -0.43±1.55 and -0.67±1.13 respectively, while there was no statistically significant ($p>0.05$) relationship between these anthropometric variables and the sex of the pupils. However, urban pupils had a statistically significant ($p<0.05$) higher weight and height in comparison with their rural counterparts who on the other hand had statistically significant ($p<0.05$) higher HAZ and BAZ which translates to a higher amount of wasting and stunting among the urban pupils*

Conclusion: *Children in urban primary schools are taller and fatter but more stunted and wasted. Hence, appropriate nutritional education programmes should be initiated for pupils, parents, and teachers, while more efforts should be made to improve the current school feeding program.*

KEYWORDS: *Anthropometric indices, Nutrition, pupils, Urban, Rural*.

INTRODUCTION

Adequate nutrition is a vital determinant of the state of health, development and growth of children, as well as their quality of life in general.[1-3] The nutritional status of children has been identified to have some vital impact on their survival mainly due to the synergistic relationships between malnutrition, diseases and cognitive functions.[4] Abdulkadir, Tefera and Habtemu[5] also stated that nutrition has a powerful influence on learning and academic performance, while some other studies have also shown that poor nutritional status is associated with low school

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enrolment, high absenteeism, poor academic performance, early dropout, delayed cognitive development, reduced intellectual achievement, increased childhood morbidity and mortality.[6,7]

Assessing the nutritional status which entails the measurement for stunting, wasting, obesity, overweight, and underweight among children, is an essential part of monitoring the health of a community. One of the most practically useful means for this assessment remains the application of anthropometric measurements.[8] It serves as an appropriate data gathering processes to enable accurate planning and implementation of interventions to reduce morbidity and mortality associated with malnutrition.[9] In children, the three most commonly used anthropometric indices are weight – for – age (W // A) which is an index of underweight / overweight, height – for –age (H // A) which is an index of stunting, and weight – for – height (W // H) which is an index of wasting.[17] These can be expressed in terms of Z – scores or standard deviation score, which is the deviation of the value for an individual from the median value of the reference population divided by the standard deviation for the reference population.[11,12]

The application of the anthropometric measurements in the determination of the nutritional status of children according to the UNICEF, WHO, and World Bank shows that approximately 155 million children (22.9%) are stunted and about 52 million children (7.7%) are wasted.[13] This is more prevalent among children in sub-Saharan Africa (SSA) and Southern Asian countries.[14,15] In Nigeria, the recent National Demographic Health Survey (NDHS) report showed that 37% of children under age 5 are stunted (too short for their age) and 17% are severely stunted; seven percent are wasted (too thin for their height), with 2% being severely wasted; twenty-two percent of children are underweight (too thin for their age), and 7% are severely underweight, while only 2% of children are overweight.[10] However, most of these assessments has continued to focus on infants aged 6 – 59 months (under 5 children), with less attention placed on primary school children aged 6 – 12 years which are considered difficult-to-measure and hard-to-reach population. Despite this, the primary school age represents a dynamic period of physical growth, enormous physiological, cognitive, and psychosocial development of children.[16] Hence, this study sough to investigate and compare the anthropometric indices of nutritional status of public primary school pupils in urban and rural areas of Warri South Local Government Area (WSLGA) of Delta state, Nigeria.

METHODOLOGY

Study Design and setting

This study was designed as a school based comparative cross-sectional survey and was carried out in WSLGA which is saddled with great number of public primary schools. According to the record of the statistics division of the state Ministry of Education, there are 54 public primary schools in WSLGA, with population of 20,655 pupils (the third highest in the state).

Study Population

The target population for this study consisted of apparently healthy pupils, aged 6 – 12 years, registered in public primary schools within the WSLGA.

Sample Size Determination and Sampling Techniques

A sample size of 236 (118 for rural and urban each) was determined using the double proportion comparison formula[18] with 95% confidence interval, a power of 80%, 5% margin of error, 27% and 45% prevalence of stunting among Children in urban and rural areas respectively,[10] and a 10% non-response rate.

The selection of the participants was based on multi-staged sampling which first identify the public primary schools in the LGA using the list of schools provided by the Universal Basic Education (UBE). The schools were stratified them into urban and rural primary schools, and a total of 4 primary schools randomly selected from each area, followed by random selection of the arms per each grade by balloting and lastly, simple random selection of pupils from the selected arms.

Study Instruments

The bio-data and lifestyle habits of the pupils were collected with the aid of a pretested questionnaire adapted from Hassan et al. (2017), while the measurements of the weight and height of the pupils were obtained from each pupil according to the protocol described by WHO.[17] Their weights were taken with the aid of an electronic weighing scale (Camry Model Number BR9011) in accordance with Ivanovic et al.[19] and this was done in the morning (immediately after assembly), as it is known that there are diurnal variations in weight.[20] The height or stretch stature was determined in accordance with Ivanovic et al.[19] and Eze et al.[21] with the aid of a portable height measure (Seca® stadiometer). The weight and height were converted to nutritional indices: weight-for-age *z*-score (WAZ), height-for-age *z*-score (HAZ) and body mass index-for-age Z-scores (BAZ) which were obtained using the WHO AnthroPlus software for measuring malnutrition in school-age children and adolescent aged 5 – 19 years.[22,23]

Statistical Analysis

The anthropometric data calculated by application of the WHO growth references and analysed with IBM Statistical Package for Social Sciences Software (SPSS vs 23). The results were expressed as percentages and presented in tables and charts. Descriptive statistics was used to determine the frequency and standard deviations (SDs) of the anthropometric measurements while differences in means across the two areas (urban and rural), were compared using Student's t-test.

Ethical Statement

Ethical approval was obtained from the Ethical Review Committee of University of Port Harcourt, while official permission was obtained from the Delta state ministry of

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education before carrying out this study. The Head teachers at the schools were duly informed of the nature of the study and their permission granted while written informed consent form was used to obtain permission from the parents of the pupils. The pupils also gave assent and were informed of their right to withdraw from the study at any point.

RESULTS

Socio-demographic characteristics of Primary school pupils and their Parents

Table 1: ***Age and sex pupils and characterizes of their parents***

Variables (n=330)	Urban (n=165) n (%)	Rural (n=165) n (%)	X^2(P-value)
Age category			
6	7 (4.2)	8 (4.8)	
7	34 (20.6)	17 (10.3)	
8	25 (15.2)	26 (15.8)	
9	33 (20.0)	7 (4.2)	*39.286 (<**0.0001***)*
10	22 (13.3)	44 (26.7)	
11	26 (15.8)	22 (13.3)	
12	18 (10.9)	41 (24.8)	
Sex			
Male	83 (50.3)	85 (51.5)	*0.924 (0.826)*
Female	82 (49.7)	80 (48.5)	
Educational level of parent			
None	9 (5.5)	47 (28.5)	
Primary	24 (14.5)	64 (38.8)	*113.130 (<**0.0001***)*
Secondary	44 (26.7)	47 (28.5)	
Tertiary	88 (53.3)	7 (4.2)	
Occupational status of parent			
Farmer	10 (6.1)	24 (14.6)	
Artisan	105 (63.6)	136 (82.4)	*46.840 (<**0.0001***)*
Employee	39 (23.6)	3 (1.8)	
Unemployed	11 (6.7)	2 (1.2)	
Type of family			
Nuclear	155 (93.9)	158 (95.8)	*0.558 (0.455)*
Extended	10 (6.1)	7 (4.2)	
Size of family			
Three	17 (10.3)	13 (7.9)	*10.140 (**0.006***)*
Four	63 (38.2)	39 (23.6)	
Five or more	85 (51.5)	113 (68.5)	

* Statistically significant (*p<0.05*)

The result presented in Table 1 above shows the age, sex distribution and family characteristics of the families of the primary school children in urban and rural communities in WSLGA. According to the findings, the mean age of all primary school children was found to be 9.43 ± 1.84 years while the median age was 10 years. According to the result, there was a statistically significant (p = 39.286; X^2 <0.0001) difference between the age of the pupils as more of the children in the urban schools, 34 (20.6%) and 33 (20.0%) were aged 7 and 9 years respectively while majority of the children in rural schools, 44 (26.7%) and 41 (24.8%), were seen to be aged 10 and 12 years old respectively. However, there was no statistically significant (p > 0.05) difference between the sex of the pupils, as the result showed that males (50.9%) were slightly more than the females (49.1%). Also, the analysis of the educational and occupational status of the parents revealed a statistically significant (p < 0.05) higher difference between the parents of the pupil in the urban areas than those in the rural areas while there was no statistically significant (p > 0.05) difference between their type of families. However, the size of the family revealed a statistically significant (p < 0.05) higher difference between the families of the pupil in the urban areas than those in the rural areas.

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Lifestyle/dietary habits of public primary school pupils in WSLGA

Table 2: ***Distribution of lifestyle/dietary habits of pupils in urban and rural public primary schools***

Variables (N = 330)	Urban (n = 165) n (%)	Rural (n = 165) n (%)	X^2(P-value)
Regular exercise			
Often	103 (62.4)	125 (75.8)	*8.288F* ***(0.008*)***
Sometimes	62 (37.6)	39 (23.6)	
Rarely	0 (0.0)	1 (0.6)	
Eating breakfast			
Often	145 (87.9)	50 (30.3)	
Sometimes	18 (10.9)	110 (66.7)	*113.693 F* ***(<0.0001*)***
Rarely	2 (1.2)	5 (3.0)	
Watching TV while eating			
Often	45 (27.3)	2 (1.2)	
Sometimes	78 (47.3)	132 (80.0)	*54.884* ***(<0.0001*)***
Rarely	42 (25.5)	31 (18.8)	
Eating poultry at least thrice per week			
Often	105 (63.6)	27 (16.4)	
Sometimes	56 (33.9)	137 (83.0)	*85.345 F* ***(<0.0001*)***
Rarely	4 (2.4)	1 (0.6)	
Eating fish at least once per week			
Often	94 (57.3)	38 (23.0)	
Sometimes	64 (39.0)	127 (77.0)	*51.466 F* ***(<0.0001*)***
Rarely	6 (3.7)	0 (0.0)	
Consuming milk and dairy at least once daily			
Often	63 (38.2)	21 (12.7)	
Sometimes	91 (55.2)	128 (77.6)	*28.177* ***(<0.0001*)***
Rarely	11 (6.7)	16 (9.7)	
Eating fruit and vegetable at least once per week			
Often	61 (37.0)	9 (5.5)	
Sometimes	101 (61.2)	154 (93.3)	*53.862* ***(<0.0001*)***
Rarely	3 (1.8)	2 (1.2)	

* Statistically significant (*p<0.05*) *F = Fisher's exact test*

The responses of the pupils to questions regarding their lifestyle/dietary habits is analysed and tabulated above (table 2). According to the result, 69.1% of the pupils engage in regular exercise often, with 75.8% of the pupils in rural public primary schools reportedly engaging in regular exercise more than their urban counterpart (62.4%), thereby showing a statistically significant (p<0.05) difference. Also, 59.1% and 63.6% of the pupils reported that they eat breakfast often and watch TV while eating respectively, with more of the urban pupils (87.9% and 27.3%) eat breakfast more often and watch TV while eating respectively. This also showed a statistically significant (p<0.05) difference between breakfast eating habit and that of watching TV while eating between the urban public primary school pupils and rural pupils. Also, more of the children in the urban public primary schools (63.6%, 33.9%, 38.2% and 37.0%) reported that they often eat poultry at least thrice per week, eat fish at least once per week, consume milk and dairy at least once daily and eat fruit and vegetable at least once per week respectively. Hence a significant (p<0.05) difference was observed between the pupils in urban and rural public primary schools in terms of eating poultry at least thrice per week, eating fish at least once per week, consuming milk and dairy at least once daily and eating fruit and vegetable at least once per week.

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Nutritional status of public primary school pupils in WSLGA

Table 3: ***Anthropometric indices of public primary school pupils in WSLGA***

Variables (N = 330)	Mean ± SD	Sex			School location		
		Male Mean ± SD	Female Mean ± SD	p-value	Urban Mean ± SD	Rural Mean ± SD	p-value
Weight (Kg)	26.67±5.77	26.46±5.38	26.88±6.16	*0.511*	27.71±6.24	25.63±5.07	***0.001****
WAZ	-0.96±1.49	-0.89±1.51	-1.03±1.47	*0.379*	-1.12±1.16	-0.81±1.74	*0.058*
Height (m)	1.32±0.10	1.31±0.10	1.32±0.10	*0.657*	1.34±0.09	1.31±0.11	***0.06****
HAZ	-0.43±1.55	-0.41±1.53	-0.44±1.58	*0.906*	-1.01±1.22	0.16±1.63	***0.008****
BAZ	-0.67±1.13	-0.68±1.13	-0.65±1.14	*0.823*	-0.84±0.99	-0.50±1.24	***0.0001****

***** Statistically significant (*p<0.05*); **SD** – Standard deviation; **WAZ** – Weight -for-age Z-score, **HAZ** – Height-for-age Z-score, **BAZ** – BMI-for-age Z-score

Table 3 above shows the anthropometric findings of the nutritional status of the public primary school pupils. As tabulated, the mean weight (kg) of the pupils is 26.67±5.77 while their height (m) is 1.32±0.10.Their Wight-for-age Z-score (WAZ), Height-for-age Z-score (HAZ) and BMI-for-age Z-score (BAZ) was recorded as -0.96 ± 1.49, -0.43 ± 1.55 and -0.67 ± 1.13 respectively. The result for WAZ showed that the pupils are of normal/healthy weight, while that of HAZ shows that they are equally of normal or healthy height. Lastly, the value obtained for BAZ in this study shows that the pupils are of normal Body mass index (BMI).

Comparison of the mean anthropometric parameters across the sex of the public primary school pupils showed similarities in weight (26.46 ± 5.38 and 26.88 ± 6.16), height (1.31 ± 0.10 and 1.32 ± 0.10), WAZ (-0.89 ± 1.51 and -1.03 ± 1.47), HAZ (-0.41 ± 1.53 and -0.44 ± 1.58) and BAZ (-0.68 ± 1.13 and -0.65 ± 1.14) for males and females respectively. This shows no statistically significant (p>0.05) difference between the anthropometric parameters of the male and female pupils.

The parameters were also compared with respect to the location of the school. According to the findings, the mean weight, height, WAZ, HAZ and BAZ of pupils in urban public primary schools were 27.71 ± 6.24, 1.34 ± 0.09, -1.12 ± 1.16, -1.01 ± 1.22 and -0.84 ± 0.99 respectively, while their rural counterpart had 25.63 ± 5.07, 1.31 ± 0.11, -0.81 ± 1.74, 0.16 ± 1.63 and -0.50 ± 1.24. This result shows that there is no statistically significant (p>0.05) difference between the WAZ of the pupils in urban and rural public primary schools while significant (p<0.05) differences exists between their weight, height BAZ and HAZ.

DISCUSSION

Comparing the Nutritional Status of pupils in Urban and Rural Public Schools

Nutritional status is the condition of health of the individual as influenced by the utilization of the nutrients,[24] hence its regular monitoring among primary school aged children is especially relevant as they need more nutrients than adults in relation to their body weight.[25] According to Etim, Ejemot-Nwadiaro, and Kalu,[15] nutritional anthropometry is a technique that measures the physical dimensions and gross composition of the human body as a way of assessing nutritional status. This method of assessment remains the standard measurement of assessing malnutrition which actually means undernutrition and overnutrition.[3] As stated by the Caribbean Food and Nutrition Institute in 2005, it also has a great impact on the health systems and learning capacity of children as well as their productivity as adults and on the quality of life in general.[26]

According to the findings, there was no statistically significant (p>0.05) difference between the WAZ of the pupils in urban and rural public primary schools while significant (p<0.05) differences exists between their weight, height HAZ and BAZ. The result also showed that the urban pupils weighed more (27.71 ± 6.24) than the rural (25.63 ± 5.07), were taller (1.34 ± 0.09) than the rural (1.31 ± 0.11) and had a better BAZ (-0.84 ± 0.99) than the rural (-0.50 ± 1.24). However, the HAZ and WAZ for the rural pupil (0.16 ± 1.63 and -0.81 ± 1.74 respectively) was better than the urban (-1.011.22 and -1.12 ± 1.16 respectively). Congruent with this finding, the study of Gonzalez-Suarez et al.[27] showed that most of the urban children in Filipine were overweight and obese, while the studies of Islam et al.[24] and Bharati et al.[28] reported that children in urban area were heavier and taller compared to the rural children.

These differences according to Eze et al,[21] could be related to difference in methodology or study instruments such as the reference indices used, secular/time trends, and sociocultural factors. With regards to the study instrument, WHO recommends the use of Z-score-related indices in the assessment of physical growth and nutritional status, irrespective of ethnicity, socioeconomic status, and feeding mode.[4] The standards make use of multiple indicators based on Z-score which is preferred because they permit clinical tracking of patients whose anthropometric classification lies beyond the measurable limits of the percentile range such as those with severe undernutrition and severe obesity.[21] Furthermore, it is also the belief of Bello et al.[2] that the frequency of milk consumption may contribute significantly to the variations in the nutritional status. This is so as the mean weight and height of pupils in the urban area were higher than those in the rural areas.

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Conclusion and Recommendation

The result from this study revealed statistically significant ($p<0.05$) differences between the weight, height HAZ and BAZ of the pupil which signified that the urban pupils weighed more and were taller, while their rural counterparts had higher HAZ and BAZ score. This shows that more of the urban pupils are stunted (too thin for their height) and wasted (too thin for their age). Hence, the state government should initiate some comprehensive public health intervention measures geared towards nutritional education programme for pupils, parents and teachers to promote nutritional health as well assist the efforts of the federal government in the school feeding programme to help improve the nutritional indices of these pupils

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