ORIGINAL ARTICLE

Nutritional Status of Primary School Children in Enugu, Nigeria Using Anthropometric Measurements

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DISCLOSURE
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ABSTRACT

Background: The survival and wellbeing of children is largely dependent on nutrition. Malnutrition in children can co-exist as under- and over-nutrition in the same population with varying attendant medical risks.

Objective: The aim of this study was to determine the nutritional status of primary school children in Enugu North LGA, using anthropometry.

Methodology: This was a cross sectional descriptive study involving primary school children aged 6-12years in Enugu. Subjects were selected using multistage sampling technique over a 3 month period. Weight and height were measured using a digital scale and a wooden stadiometer, respectively. Weight-for-age, Height- for -age and Body Mass Index-for-age z scores were then derived using the new WHO reference standards.

Results: Three hundred and forty eight (40.4%) children were recruited from public schools while 512 (59.6%) were recruited from private schools. The mean age of the study subjects was 9.18 ± 1.79 years. Seven (0.8%) children were stunted, 26 (3.3%) wasted and 28 (3.3%) underweight. Overweight and obesity were observed in 73 (8.5%) and 35 (4.1%) children, respectively. Under-nutrition was more prevalent in children aged 12 years (P= 0.001) whereas males were found to be more obese than females (P= 0.02).

Conclusion: There was a low prevalence of under nutrition. However, overweight and obesity appear to be emerging as nutritional problems.

Key words: *Nutrition, Obesity, Stunting, Underweight, Wasting, Anthropometry*

INTRODUCTION

Nutrition is the sum total of the processes involved in the intake and utilization of food substances by which growth, repair and maintenance of the body are accomplished.[1] It is a fundamental pillar of human life, health and development across the entire life span.[2] The socioeconomic development of a country is largely dependent on nutrition as adequate food and good nutrition are vital for survival, physical growth, and mental development.[3,4] Malnutrition is a silent emergency which has devastating effects on children, the society and the future of humankind.[5]

Nutritional status is the extent to which the customary diet of any population group has been able to meet their nutritional requirements.[6] It is an important determinant of growth and is the best indicator of the global wellbeing of children.[7] The efficiency with which the body utilizes the food consumed is a key determinant of nutritional status.[8] When the nutritional status of children deteriorates, it leads to a vicious cycle of recurring sickness and growth failure.[8] Therefore, an in-depth knowledge of the nutritional status of children has far reaching implications for promoting the health of future generations.[8]

Nutritional assessment is a detailed evaluation of objective and subjective data relating to an individual's food intake, lifestyle and medical history.[9] The results of this assessment then leads to either a plan of care or intervention designed to help the individual maintain the assessed status or attain a healthier status.[9] In any community, nutritional assessment is essential for accurate planning and implementation of intervention programmes which are designed to reduce the morbidity and mortality associated with malnutrition.[10,11] The most frequently used quantitative method for assessment of the nutritional status of individuals or population groups is anthropometry.[12]

Primary school age is a period of dynamic physical growth and mental development.[13] Research has shown that poor nutritional status results in low school enrolment, high absenteeism, early dropout and unsatisfactory classroom performance.[13] Well-nourished children are poised to perform better in school and are able to achieve their full physical and mental potential.[14]

Several studies have been conducted worldwide on nutritional status of children of all ages. In Nigeria, a good number of studies have shown a high prevalence of undernutrition among children.[10,11,15] However, over nutrition is also an emerging health challenge in the country. This study sought to evaluate the prevalence of under and over nutrition among children attending primary schools in Enugu-North Local Government Area (LGA) of Enugu State, Nigeria.

METHODOLOGY

Study Design

This was a cross sectional descriptive study involving primary school children.

Study Area and Population

The study was carried out between the months of March and July, 2013 in 14 randomly selected primary schools (9 private, 5 public) in Enugu-North LGA. There were 139 primary schools comprising 51 public and 88 private schools with a total school population of 82,116 pupils (13,855 public and 68,261 private), in the local government.

Inclusion Criteria

Primary school children aged 6-12 years attending registered public and private primary schools in Enugu North LGA.

Exclusion Criteria

Children with skeletal deformities, those whose age could not be ascertained or were on medications known to affect growth such as steroids were excluded from the study. In addition, those with history and physical findings suggestive of chronic disorders like sickle cell disease and heart disease were excluded.

Sample Size Determination

The sample size for the study was calculated using the formula below.[16]

$$n = \frac{Z^2pq}{d^2}$$

Where n = the desired sample size when the population is more than 10,000
Z = the standard variation, usually set at 1.96 (which corresponds to 95% confidence interval)
p = the proportion in the target population estimated to have a particular characteristic. (Prevalence of under-nutrition recorded in Uyo, Akwa Ibom state: 39.4%=0.394)[17]
q = 1.0 – p
d = degree of accuracy desired; set at 0.05
Therefore the minimum sample size

$$n = \frac{(1.96)^2(0.394)\ (0.606)}{(0.05)^2} = 367$$

A non-response rate of 10% was anticipated, hence the sample size was increased to 404.

Since anthropometric surveys are designed as cluster samples and not simple random samples, the difference in design has to be corrected for. This is done by multiplying the sample size by the design effect (D).[18]
For nutritional surveys using cluster sample methodology, the design effect is assumed to be 2.
Thus, the final sample size for the study was 810.

Sampling Method
A multi-stage sampling method was used. A list of primary schools in Enugu North LGA was obtained from the Enugu state Ministry of Education. All the primary schools were grouped into public and private. The ratio of public to private schools in the study area is 1:1.7, therefore 5 public schools and 9 private schools were selected for the study. This selection was done by simple random sampling without replacement. Thus, a total of 14 schools were selected for the study. In the next stage, the number of subjects to be selected from each school was determined using the Neymann allocation formula for stratified sampling as follows; [19]

For each school, Sample size allocated =
$\frac{\text{Total population of the index school}}{\text{Sum of the population of 14 schools}}$ X Total sample size

In each selected school, the allocated sample size was proportionately divided among each grade, and the total number of students in each section constituted the sampling frame in that grade. The allotted sample was then divided according to the number of classes in each grade. In each class, the participants were selected by simple random sampling using a statistical table of random numbers until the required number for the class was obtained.

Ethical Approval and Consent
Ethical approval was obtained from University of Nigeria Teaching Hospital Health Research Ethics Committee. Permission was also obtained from the Enugu State Universal Basic Education board (ESUBEB) and from various head teachers of the selected schools. Written informed consent was obtained from parents of the selected pupils. Assent was obtained for the older children prior to data collection.

Data Collection
A proforma designed for the study was used to record the information obtained. The weight and height measurements were carried out according to standard procedures described by WHO.[20] All measurements were taken with the children wearing light clothing and without shoes. Each child was weighed using a calibrated standardized digital weighing scale (OMRON BF -400), with the accuracy of the scale to the nearest 0.1kg. The weight was recorded twice and the average value used in the analysis. The scale was set to zero point before each use and checked for accuracy with standard weights after every 20 measurements or whenever the scale was moved from place to place. Heights were measured with a locally constructed wooden stadiometer placed on a flat surface measured to the nearest 0.1cm. Two measurements were taken and the average value was obtained.

BMI was calculated using the formula

$$BMI = \frac{\text{Weight (Kg)}}{\text{Height (M}^2\text{)}}$$ [21]

Weight-for-age, Height-for-age, and BMI-for-age were derived from the new WHO standard/ reference.[20] Computed Z scores for BMI for age , weight for age and height for age were then used to assess underweight, wasting, stunting, overweight and obesity using the recently published WHO reference standards.[20]

Normal height was defined as height for age which is between -2 and +2 Z score while normal weight was defined as weight for age between -2 and +2 Z score.[20] Stunting was defined as height for age less than -2 Z score. Underweight was defined as weight for age less than -2 Z score.[20] Wasting was defined as BMI for age less than -2 Z score.

Obesity was defined as BMI greater than +2 Z score, while overweight was defined as BMI for age between +1 and +2 Z score.[20]

Data Analysis

The data was analyzed using IBM Statistical Package for Social Sciences (SPSS inc. Released 2009. PASW Statistics for windows, Version 18. Chicago: SPSS Inc.) Descriptive statistics which include frequency, percentages, means and standard deviations was used to summarize the variables. Logistic regression was used to determine association between categorical variables, while comparison of means between public/private schools was done using the Student's t test. All tests were 2-tailed and significance was set at *P*-value less than 0.05.

RESULTS

A total of 860 subjects were recruited for the study, out of which 348 (40.4%) were from public schools and 512 (59.6%) were from private schools. Table 1 shows the gender and age distribution of study subjects in the public and private schools.

There were 396 (46%) males and 464 (54%) females with a male to female ratio of 1:1.2. Their age ranged from 6years to 12 years with a mean of 9.18 ± 1.79 years.

Table 2 and 3 below shows the summary of the nutritional status of the study subjects and the gender differences in nutritional status. Most of the subjects (80.3%) had normal nutritional status. Seventy-eight percent of them were males while 82.3% were females. More males (5.8%) than females (2.6%) had obesity and this was statistically significant (*P*-value = 0.02).

Table 1. Gender and age distribution of the study subjects in private and public schools

Variables	Private schools n (%)	Public schools n (%)
Sex		
Male	259 (50.6)	137 (39.4)
Female	253 (49.4)	211 (60.6)
Age (years)		
6	55 (10.7)	28 (8.0)
7	48 (9.4)	26 (7.5)
8	115 (22.5)	56 (16.1)
9	91 (17.8)	53 (15.2)
10	99 (19.3)	57 (16.4)
11	68 (13.3)	65 (18.7)
12	36 (7.0)	63 (18.1)

Table2. Distribution of the nutritional status of the study participants

Nutritional Status	Frequency	Percent
Normal	691	80.3
Stunting	7	0.8
Wasting	26	3.0
Underweight	28	3.3
Overweight	73	8.5
Obese	35	4.1
Total	**860**	**100.0**

Table 3. Gender differences in nutritional status of the study subjects

Nutritional Status	Male n (%)	Female n (%)	*P*-value	OR	95% C.I
Normal	309 (78.0)	382 (82.3)	0.115	1.312	0.936 – 1.837
Stunting	2 (0.5)	5 (1.1)	0.363	0.466	0.090 – 2.415
Wasting	14 (3.5)	12 (2.6)	0.247	1.412	0.787 – 2.532
Underweight	17 (4.3)	11 (2.4)	0.119	1.847	0.855 – 3.992
Overweight	31 (7.8)	42 (9.1)	0.521	0.853	0.526 – 1.386
Obese	23 (5.8)	12 (2.6)	0.020	2.323	1.140 – 4.730
Total	**396**	**464**			

Differences In Nutritional Status Between Subjects in Public and Private Schools

As illustrated in Table 4 below, overweight and obesity were found to be significantly higher in private school children than in public school children ($p<0.001$)

Table 4. Differences in nutritional status between subjects in public and private schools

Nutritional status	Private school n (%)	Public school n (%)	OR	P- value	95% C.I
Normal	384 (75.0)	307 (88.2)	0.401	< 0.001	0.273 – 0.587
Stunting	3 (0.6)	4 (1.1)	0.507	0.376	0.133 – 2.279
Wasting	10 (2.0)	16 (4.6)	0.725	0.281	0.405 – 1.300
Underweight	19 (3.7)	9 (2.6)	1.452	0.364	0.649 – 3.247
Overweight	64 (12.5)	9 (2.6)	5.381	<0.001	2.641 – 10.965
Obese	32 (6.3)	3 (0.9)	7.667	0.001	2.329 – 25.239

DISCUSSION

In the present study, majority of the children had normal nutritional status, which is comparable to similar studies from Nigeria and Pakistan.[22,23,24] The prevalence of stunting, wasting and underweight in this study were 0.8%, 3.0% and 3.3%, respectively. This was similar to findings by authors in North India, Pakistan and Malaysia.[24,25,26] However, this was at variance with other Nigerian studies which reported higher prevalence rates.[15,17,22]

The lower prevalence of stunting, wasting and underweight in the present study may be due to the fact that the study was conducted in an urban area. Senbanjor *et al*. documented higher prevalence rates for wasting, stunting and underweight in a rural community in South-West Nigeria.[27]

These variations in prevalence rates may also be attributable to differences in methodology. The new WHO reference values used in the present study are more widely applicable and had been projected to diagnose various forms of under and over-nutrition to variable extents from what was previously known with the National Centre for Health Statistics (NCHS) references.[27,28]

The prevalence of overweight and obesity in the present study was comparable to the findings by Nwaiwu *et al.* in Edo state Nigeria, who reported prevalence rates of 6.4% and 1.7% respectively.[29] Similarly Wang, in an earlier cross national comparison of childhood obesity, reported 10% and 6% for overweight and obesity respectively among Russian school children.[30] However, the prevalence of obesity in the current study was higher than that reported by Ene-Obong *et al.* in a study conducted in four major cities (Lagos, Port Harcourt, Nsukka and Aba) in southern Nigeria.[31]These variations in prevalence could be a result of socio-cultural differences.

The gender differences in nutritional status for stunting, wasting and underweight in the present study were not statistically significant. This is different from findings by other Nigerian authors who documented

higher prevalence of malnutrition among boys than girls at all ages.[22,34,35] However, obesity was found to be significantly higher in males. This is in contrast to higher prevalence of overweight and obesity previously reported among females.[30,31,36] Some studies done have shown that males, usually spend longer hours watching television and playing video games, thus increasing the risk of obesity.[37]

In the present study, stunting and wasting were found to be higher among children attending public schools than those in private schools, while underweight was slightly higher in private schools than in children attending public schools. This is similar to findings by Akor *et al*. in Jos, and Omigbodun *et al.* in Ibadan.[35,38] Wamani *et al*., in a meta-analysis of 16 demographic and health surveys in Sub Saharan Africa also reported higher underweight and stunting rates in public schools, than in private schools.[39] This may be explained by the fact that children in the public schools were possibly from poorer background than their counterparts in private schools. In addition, the types of food available and environmental factors also play a role. The findings in the present study differed from that of Opara *et al*. in Uyo who reported an unexpectedly high rate of stunting and underweight in children in private schools.[17] However, this was still significantly lower than the rate for stunting and underweight in children in public schools.

As expected, overweight and obesity were significantly higher in the children attending private schools than those in the public schools. This was similar to findings from study conducted in Burkina Faso.[40] The possible explanation for this could be the affluence of children in the private schools, with resultant increase in consumption of fat and refined sugar diet.

CONCLUSION

The findings in this study show a low prevalence of under nutrition in Enugu-North LGA. However, overweight and obesity appear to be emerging as nutritional problems especially among children in the private schools. It is therefore pertinent that awareness be created on the benefits of optimal nutrition and balanced diet, and the need for adequate physical activity to reduce the risk of obesity and its complications.

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