## ORIGINAL ARTICLE

# Determination of the nutritional status of a population of school-age children in Anambra State using anthropometric measurements

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**ABSTRACT**

**Background:** Nutrition assessment in the community is essential for accurate planning and implementation of intervention programmes to reduce the morbidity and mortality that are associated with malnutrition.
**Objective:** This study is aimed at determining the nutritional status of a population of school-age children in Anambra State using anthropometric measurements.
**Methodology:** A sample size of 1288 school children in Anambra State was used for the study. The data were organized and tested with inferential statistics of *t-Test*.
**Results:** The results showed that school children aged 6–11years in the urban areas had lower BMI compared to those in the rural areas. The BMI of school children aged 6-11years in both urban and rural locations were higher than those of WHO/NCHS reference BMI for their ages.
**Conclusion:** There is a significant difference in the nutritional status of school children in Anambra state based on their location and gender. Based on the findings of the study, it is recommended that school health services be re-activated in Anambra State.

***Keywords:*** *Anthropometric variables, growth monitoring, location, malnutrition, socioeconomic class*

INTRODUCTION

The nutritional status of the child population is an important indicator of health and quality of life, reflecting not only the reality of this particular group, but, also the society in which the child lives. Malnutrition among children is a major public health problem in developing countries.[1]Malnutrition refers to an imbalance of nutrient intake due to the consumption of too little or too much of one or more nutrients which usually presents symptoms of poor growth and development.[2,3]

Anthropometric indicators, based on weight and height, are universally used to characterize the nutritional status of populations. These indicators are indices obtained from the combined use of two or more anthropometric variables such as weight for height (W/H), weight for age (W/A) and height for age (H/A). The World Health Organization (WHO) has recommended the use of Z-score of these indicators to classify nutritional status given the constancy of their values.

Normal growth is a reflection of the overall health and nutritional status of an individual which is determined by the measurement of his/her body weight and height. Body Mass Index (BMI) is described as a measure of a person's weight, taking into account his/her height.[1]The BMI chart can be a useful tool for visualizing the ranges for underweight, healthy weight, overweight, and obesity based on a person's height.[2]

Growth monitoring is an important standard component of the child health services used to assess the growth and nutritional status of school children.[4,5]In a cross-sectional study conducted to evaluate physical growth and nutritional status of 214 school-going girls ranging in age from 5 to 12years of rural area in Pauri, Garhwali District of Uttaranchal, nutritional status was assessed using weight, height and upper arm circumference for age which were calculated using NCHS standards.[6] The result of the study showed that Garhwali girls were found to be comparable with other rural girls in their growth status.[6]

In another cross-sectional study to determine the physical development norms for assessing children 5-12years in the southern part of Nigeria, particular reference was made to their physical characteristics which included height, weight and body mass index.[7] Two thousand, eight hundred and six (2806) school children randomly selected from the South-South, South-East and South-West Zones of Nigeria participated in this study. Weight and height were measured and BMI was calculated. The mean, standard deviations and T-scale table for the three variables were obtained.

The results showed that the variables have the same value as reported on American/European children by other studies. The study, also, showed that the three variables indicated no significant difference in the value recorded for both sexes. The researchers attributed this to the fact that the age range was close and falls within the period when growth and development are usually at par in boys and girls before entering the teens. The study recommended the need to study children within this same age range from other parts of the country in order to prepare norms that are home based and suitable for use in evaluating Nigerian children.[7]

On the basis of these, the researchers were motivated to carry out this study aimed at determining the nutritional status of a population of school-age children in Anambra State using anthropometric measurements.

OBJECTIVES

The aim of this study was to determine the nutritional status of school children aged 6-11years based on their body mass index for age Z-score and to compare the measurements with those of WHO/NCHS recommended standards for their ages. This study is important since it will help to establish growth standards (compared with WHO/NCHS standards) for weight and

height of school children in Anambra State. It will serve as a valuable and potential contribution to nutritional education, food policy and planning.

METHODOLOGY

The cross-sectional comparative survey design was used to conduct this study aimed at determining the nutritional status of school-age children using anthropometric measurements. This study was conducted in Anambra State of Nigeria with its capital at Awka. Anthropometric measurements of the weights and heights of school children as well as their body mass index was undertaken to determine their nutritional status. The sample consists of 1288 primary school children drawn from the population of all public schools approved by the State Ministry of Education in three selected education zones. A multi-staged sampling technique was used to select the sample for the study.

Data for the study were collected using standard instruments for anthropometric assessment. The main instruments were the standard portable measuring rule calibrated in centimetres for measurement of height and standard bathroom weighing scale for measuring the weight. A proforma was used to record the measurements and also, data on the age, gender and location of school of the children. Height and weight were measured according to International Society for Advancement of Kinanthropometry (ISIAK) standards for anthropometric assessments.[8]The children were on their school sport shorts and vest, barefoot; standing erect on the weighing scale, looking straight ahead, and relaxed. The researchers took the readings when the pointer stabilized to the nearest decimal and recorded in kilogrammes. Height measurement was taken on the ruler calibrated in centimetres against the vertex of the head. Body mass index was calculated from their respective height and weight using the formula (BMI = Weight/Height$^2$).

The data was summarized using descriptive statistic of mean and standard deviation. Comparative analyses between variables were done using independent sample *t-test*. Statistical significance was set at $p<0.05$ level of significance. All statistics were done using Statistical Package for Social Sciences (SPSS) for Windows (version 16.0). The data were presented in tables, bar charts and line graphs for ease of comparison with those of WHO/NCHS recommended standards for their age and gender.

RESULTS

To determine the nutritional status of school children aged 6-11years based on their BMI for age Z-score, their heights and weights were appropriately measured.

Data that were obtained indicated that normal nutritional status was higher 1186 (92.6%)than all the abnormal nutritional status. Overweight recorded 55 (4.3%), thinness recorded 28 (2.2%), severe thinness recorded 11 (0.9%) while the obese category was 0%.

**Figure 1.The nutritional status of school children aged 6-11years based on BMI for age z-score**

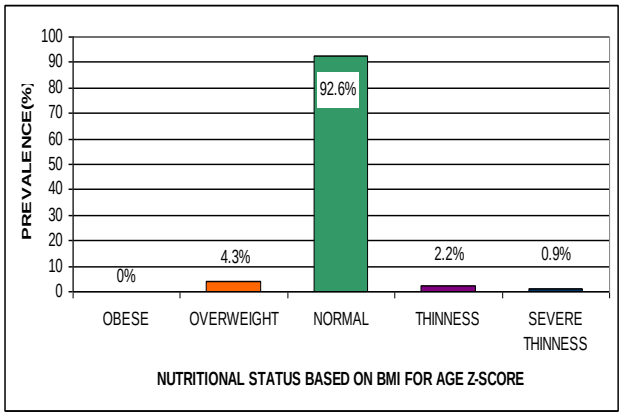



Figure 1 shows the nutritional status of the school-age children using BMI for age Z-score.

To determine the mean measurements of the BMI of school children aged 6-11years in urban and rural communities of Anambra State.

**Table 1. Mean BMI measurements of school children aged 6-11years according to location**

| VARIABLES x Measurement | URBAN (n= 587) x Measurement | Rural (n=701) | X Difference |
|---|---|---|---|
| Weight (kg) | 29.39 | 29.31 | 0.08 |
| Height (m) | 1.34 | 1.31 | 0.03 |
| BMI(kg/m²) | 16.95 | 16.18 | 0.77 |

Data in *Table 1* show that urban school children of aged 6-11years had higher mean BMI (16.95kg/m²) than those of their rural counterparts who had a mean BMI of 16.18kg/m².To compare the height measurement of school children aged 6–11years, in urban and rural communities in Anambra State with those of WHO/NCHS recommended standards for their age.

**Table 2. Mean height of 6-11year old school children compared with those of WHO/NCHS reference values in both urban and rural areas**

| Age (yrs) Children in urban Locations (kg/m²) | Mean BMI Of Children in rural Locations (kg/m²) | Mean BMI of reference BMI(kg/m²) | WHO/ NCHS |
|---|---|---|---|
| 6 | 15.7 | 16.8 | 15.3 |
| 7 | 16.5 | 16.8 | 15.4 |
| 8 | 16.2 | 17.0 | 15.7 |
| 9 | 16.3 | 17.3 | 16.1 |
| 10 | 16.2 | 16.6 | 16.5 |
| 11 | 16.1 | 17.3 | 17.0 |

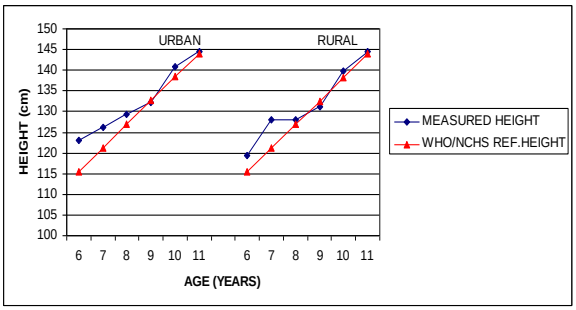
**Figure 3. BMI**

**Table 3. Measurements of school children aged 6-11years compared with those of WHO/NCHS reference values in both urban and rural areas**

| Age (yrs) | Mean height of Children in urban Locations (cm) | Mean height of children in rural locations (cm) | WHO/ NCHS reference mean |
|---|---|---|---|
| 6 | 123.1 | 119.4 | 115.4 |
| 7 | 126.1 | 127.9 | 121.2 |
| 8 | 129.3 | 125.9 | 126.9 |
| 9 | 132.2 | 131.1 | 132.5 |
| 10 | 140.9 | 139.8 | 138.2 |
| 11 | 144.5 | 144.4 | 144.0 |

Table 2 shows that the urban and rural school children of the study aged 6-7years were taller than the WHO/NCHS reference standard for their age, the height of school children in urban locations and that of WHO/NCHS reference standard were better

**Figure 2. The height of school children aged 6-11years compared with those of WHO/NCHS Reference values in both urban and rural areas**




than those in rural locations among the school children aged 8years. The table also shows that among the 9-year olds the WHO/NCHS reference value of 132.5cm were higher than the 9-year old school children of the study. The urban and rural school children of the study aged 10-11years were taller than the WHO/NCHS reference values for their age. The graphic comparison of the data in *Table 2* is shown in *Figure 2*.

The BMI of school children aged 6–11years in urban and rural communities in Anambra State was compared with those of WHO/NCHS recommended standards for their age.

**Figure 3. The mean BMI of school children aged 6-11years compared with those of WHO/NCHS reference values in both urban and rural areas**

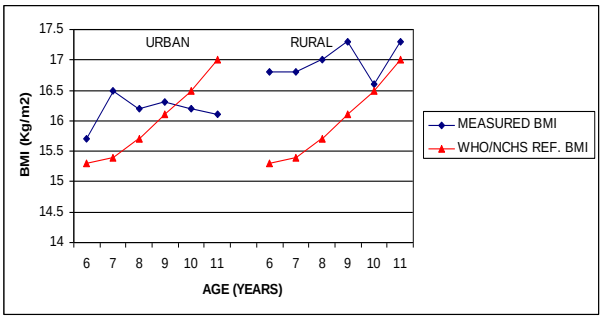



Table 3 and Figure 3 show that the school children of the study aged 6–11years residing in rural locations had better BMI measurement than their urban counterparts and those of WHO/NCHS reference standard. Also, the urban school children aged 6-9years had better BMI measurement

than the WHO/NCHS reference standard; while, the WHO/NCHS reference standard for children aged 10 and 11years were more than that of school children of urban locations of the study.

**Research Hypothesis**

There is no statistically significant difference in the mean measurements of the BMI of school children aged 6–11years plus, in urban and rural communities in Anambra State. The data verifying this hypothesis are contained in *Table 4*.

**Table 4. Summary of t–test analysis of the mean measurements of BMI of children aged 6-11years according to location**

| Variable | N | x | SD | Df | t-Cal | t-value | P-Value | Remarks |
|---|---|---|---|---|---|---|---|---|
| **BMI ($kg/m^2$)** | | | | | | | | |
| **Urban** | 587 | 16.18 | 2.01 | | | | | |
| **Rural** | 701 | 16.95 | 1.87 | 105 | 2.30 | 1.99 | <0.001 | Reject |

Table 4 presents the *t-test* summary of the mean BMI measurements of school children aged 6-11 in the urban and rural locations of Anambra State. Observation of the table shows that there was a significant difference in the mean measurements of the BMI of school children based on their location. The result shows that the calculated *t-value* of 2.30 was significantly higher than the table value of 1.99 ($p<0.001$).

DISCUSSION

The facts emerging from this study are discussed under the following subheadings:

- Related to Nutritional Status
- Related to Heights
- Related to Body Mass Index

**Related to Nutritional Status**

The results show that the mean indicators of nutritional status for school children aged 6-11years in Anambra State were found within the normal range of 86.5% to 99% (*Figures 1, 2, 3).* The normal nutritional status in children of this study is in contrast to the findings of studies carried out in other parts of Nigeria who found that children had nutritional status below normal and that under nutrition among these children were higher among the boys than the girls.[6,7,8] The findings of this study also revealed that female school children had higher mean weight and larger values for height than their male counterparts.

These findings were in line with another study which, also, indicated that the mean weight and mean upper arm circumference of girls were higher than those of boys.[9]The probable reason for this female ascendancy could be attributed to the fact that girls begin their adolescent growth spurt at an earlier age than the boys and to various nutrition policies and programmes put in place by the government and non-governmental organizations for child survival in the last decade.[9]Results obtained from the comparison with WHO/NCHS standards were good reflections of the growth and nutritional status of the school children in Anambra State.

**Related to Height**

The heights of both the urban and rural school children of the study aged 6-7years were more than the WHO/NCHS reference standard for their age while the height of school children in urban locations and that of WHO/NCHS reference standard were better than those in rural locations among the school children aged 8years. The heights of school children aged 9years had the WHO/NCHS reference value of 132.5cm and were higher than the 9year olds of the study. The urban

and rural school children of the study aged 10-11years were taller than the WHO/NCHS reference values for their age.

This is in line with the finding of another study in which the researchers attributed these differences to the fact that the age range of the school children was close, and falls within the period when growth and development are usually at par in boys and girls before entering the teens.[6]Findings have shown that factors such as socio-economic class and genetic factors have influence on the weight and height of children.[10,11] It has been observed that children of parents of high socio-economic class are about 2cm taller at three years and 5cm taller at adolescence than those of low socio-economic class.[12] Apparently this reflects the difference in nutritional habits, rest and sleep, exercise pattern and home conditions.[12]In this connection, it was reported that growth retardation is common in city slums and rural areas where there is poverty.[13,14]

**Related to Body Mass Index**

School children aged 6–11years in the urban areas indicated significantly lower BMI compared to those in the rural areas ($p<0.001$) but, there were no significant differences observed in the BMI of the male and female school children aged 6–11years. When compared to that of WHO/NCHS recommended standard for their age, the BMI of school children aged 6–11years in both urban and rural locations were significantly higher. The result for BMI compared favourably with studies by other Nigerian authors.[10,11,12]

**Implications of the Study**

The findings of the study indicated that location has significant influence on the anthropometric indicators of the school-age children. What this implies is that teachers should increase their efforts in both classroom instruction and nutrition counselling of the pupils and parents. They will guide these pupils toward healthy nutritional lifestyles that will make them attain the normal weight and height.

CONCLUSION

The study revealed that differences exist in gender and location in the values of the anthropometric variables measured. It, therefore, recommended that more calories, protein and micronutrients like iron and vitamins be given to the children in the rural area and this can be achieved through a school lunch programme, with regular growth monitoring of the Nigerian school children.

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