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ORIGINAL ARTICLE

Nutritional Status of Semi-Urban Nigerian School Children using the 2007 WHO Reference Population

L'état nutritionnel de la semi-urbaines enfants d'âge scolaire du Nigeria en utilisant la population de référence 2007 de l'OMS

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ABSTRACT

BACKGROUND: **There is paucity of data on the nutritional status of school-age children in Sagamu town of Southwestern Nigeria.**

OBJECTIVE: **To determine the nutritional status of primary school children in Sagamu Local Government Area, Nigeria.**

METHODS: **A cross-sectional survey of primary school children aged 6 to 10 years in Sagamu, Southwestern Nigeria was done. Eight schools were selected using a multi-stage sampling technique. Children randomly selected proportionately from the schools were studied. The weight-for-age, height-for-age and BMI of these children were compared with the 2007 WHO reference values to diagnose underweight (WA < –2SD), stunting (HA < –2SD), thinness (BMI < –2SD), overweight (BMI > +1SD) and obesity (BMI > +2SD).**

RESULTS: **A total of 1016 children comprising 479 (47.1%) boys and 537 (52.9%) girls were studied. The prevalence of malnutrition was 401(39.4%) and boys were more malnourished compared to girls (p = 0.002). The overall prevalences of underweight, stunting and thinness were 260(25.5%), 144(14.2%) and 226(22.2%) respectively. Overweight and obesity were present in 31(3.0%) and 5(0.5%) of the population studied respectively. Boys were significantly more often underweight and stunted.**

CONCLUSION: **The prevalence of under-nutrition among school children in Sagamu, Nigeria was high and the girls were generally better nourished than the boys. Efforts to reduce the burden of malnutrition in this population may include nutritional surveillance, food supplementation and free school meals. WAJM 2011; 30(5): 331–336.**

Keywords: **Malnutrition, Nigeria, Overweight, School children, Underweight, Stunting.**

RÉSUMÉ

CONTEXTE: Il existe peu de données sur l'état nutritionnel des enfants d'âge enfants dans la ville de Sagamu sud ouest du Nigeria.

OBJECTIF: À déterminer l'état nutritionnel des enfants du primaire dans la zone des administrations locales Sagamu, Nigeria.

MÉTHODES: Une enquête transversale des enfants du primaire de 6 à 10 ANS à Sagamu, sud ouest du Nigeria a été fait. Huit écoles ont été sélectionnées selon une technique d'échantillonnage en plusieurs étapes. Enfants choisis proportionnellement des écoles ont été étudiés. Du poids-pour-âge, taille-pour-l'âge et l'IMC de ces enfants ont été comparées aux valeurs de référence 2007, l'oms insuffisance de diagnostic (WA <-2DS), retard de croissance (HA <-2DS), minceur (IMC <-2DS) , le surpoids (IMC> +1 SD) et l'obésité (IMC> 2 SD).

RÉSULTATS: Un total de 1016 enfants, constitués 479 (47, 1%) garçons et 537 (52, 9%) filles ont été étudiés. Prévalence de la malnutrition était de 401 (39, 4%) et garçons ont plus mal nourris Comparativement aux filles (p = 0,002). Les prévalences de l'insuffisance pondérale GLOBALES, le rabougrissement et Minceur étaient de 260 (25, 5%), 144 (14, 2%) et 226 (22, 2%), respectivement. Obésité et de surpoids présent dans 31 (3, 0%) et 5 (0, 5%) de la population étudiée respectivement. Les garçons étaient significativement plus souvent insuffisant et retard de croissance.

CONCLUSION: La prévalence de sous-nutrition chez les écoliers à Sagamu, Nigeria est élevé et la les filles étaient généralement mieux nourris que les garçons. Efforts pour réduire le fardeau de la malnutrition dans cette population peut incluent surveillance nutritionnelle, supplémentation alimentaire et repas scolaires gratuits. **WAJM 2011; 30(5): 331–336.**

Mots-clés: Malnutrition, Nigeria, Surpoids Scolaires, l'insuffisance pondérale, retard de croissance

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Abbreviations: BAZ, Body mass-for-age-Z-score; **BMI,** Body mass index; **HA,** Height-for-age; **HAZ,** Height-for-age-Z-score; **NCHS,** National Centre for Health Statistics; **SD,** Z-scores; **WA,** Weight-for-age; **WAZ,** Weight-for age-Z-score;**WHO,** World Health Organisation.

INTRODUCTION

Malnutrition is a major public health issue in most parts of the developing world where it is associated with up to half of under-five.[1] That might explain why most of the available studies on childhood malnutrition had focused on the pre-school age.[2,3] Nutritional disorders beginning in the pre-school age may progress into school age if untreated and may have significant negative effects on the academic performance and general well-being the child.[4]

Previous studies of the nutritional status of children, both within and outside Nigeria, were based on the WHO definitions of the different types of malnutrition in children derived from the National Centre for Health Statistics (NCHS) anthropometric standards.[5] Thus, the prevalence of wasting, stunting, underweight, and overweight/obesity among school children have been previously reported from various populations in the developing world based on the NCHS growth standards. In Lagos, Nigeria, the prevalence rates of underweight and stunting in a cohort of school children, using the NCHS references, were 14.2% to 18.3% and 15.8% to 30% respectively.[6] In another Lagos study, the prevalence of overweight and obesity among school children was 3.7% and 0.4% using the NCHS references.[7] Using the NCHS references to diagnose malnutrition in West Bengal, India, underweight predominated among school children with a prevalence of 33.7% while the prevalence of stunting was 17.9%.[8] These reports show that malnutrition occurs in many parts of the developing world and also highlight the need to frequently review the burden of malnutrition in those places where malnutrition appears rife.

In 2006 the WHO Multicentre Growth Reference Study Group[9] worked on the premise that the NCHS anthropometric standards were derived from children in the affluent parts of the US and may not be truly representative of the growth pattern of children in less-privileged parts of the developing world. Thus, the WHO in 2007 published a new set of weight-for-age, height-for-age and body mass index standards (for the diagnosis of underweight, stunting, thinness and overweight/obesity) separately for under-five children as well as the school age children. Indeed, these new charts are closely similar to the NCHS standards and are certified applicable to all parts of the world by experts.[9] However, the new WHO charts do not contain weight-for-height standards unlike the NCHS charts. This implies that wasting cannot be assessed in children older than five years using the new WHO reference values.[10]

Literature search revealed dearth of local and international data on the clinical use of the 2007 WHO Reference values in the assessment of nutritional status of school children. There has been no previous study of the nutritional status of school children in Sagamu Local Government Area, southwestern Nigeria, hence this study. Therefore, the objective of this study was to determine the nutritional status of primary school children in Sagamu Local Government Area, Nigeria using definitions based on the latest WHO growth reference values and to encourage contemporary comparisons.

SUBJECTS, MATERIALS, AND METHODS

Survey Location

This cross-sectional survey of school children aged six to 10 years was carried out in Sagamu Local Government Area of Ogun State, southwest Nigeria. The local government area is made up of 15 political wards with the headquarters in Sagamu township. Sagamu is between Lagos, the commercial capital of the country and Ibadan, the largest city in West Africa. The local government seated on 68.03sq.km land mass has a population of about 253,412 and 167 public and privately-owned primary schools with a total enrolment of 26,547. (Unpublished data obtained from the Local Government Office of Demography and Statistics).

Sampling Frame

Using a multi-stage sampling technique, eight public primary schools were selected from eight political wards for the survey. Out of the 15 political wards in the local government, eight wards were randomly selected for the survey. Then, from the list of schools in each of the selected ward, one was also randomly selected for the survey.

Ethical Issues

A total of 1,016 children aged six to 10 years were randomly selected proportionately from the selected schools. Exclusion criteria included gross physical deformities of the limbs and spine as well as evidence of chronic illness. Institutional ethical clearance was obtained from the Olabisi Onabanjo University Teaching Hospital, Sagamu while permissions were also obtained from the relevant Education Authorities and parents.

Data Collection and Measurements

Data like age to the nearest year, sex, weight and height were collected and recorded in spread sheets of Microsoft Excel software. The portable spring balance weighing scale (Camry, England®) was calibrated in 0.5kg and was standardized daily with known weights. The height was measured with a steel tape measure calibrated in 0.1 centimetres. With the back straightened up against a wall, the heels of both feet placed together and the subject looking straight ahead, a piece of ruler was put horizontally on the vertex and the distance from the vertex to the heels represented the height as previously described.[11]

Calculations and Standardisation

From the recorded weight and height, the body mass index (BMI) for each child was calculated using the formula (wt in kg/height in m^2). The weight-for-age (WA), height-for-age (HA) and BMI for each child were standardized by converting them to Z-scores (SD) using the LMS method.[12] This was done with the age and sex specific values of LMS provided in the 2007 WHO Growth Charts.[10]

The operational definitions used in the study are shown in Table 1.[12, 13] The presence of any of underweight, stunting, thinness or overweight/obesity was defined malnutrition.

Statistical Analysis

The data were analyzed using the

Table 1: Operational definition of Variables used in the Study

Z-score for Variables	Nutritional Status
WAZ –2SD to +2SD	Normal
HAZ –2SD to +2SD	Normal
BAZ –2SD to +1SD	Normal
WAZ < –2SD	Underweight
WAZ < –3SD	Severe Underweight
HAZ < –2SD	Stunting
HAZ < –3SD	Severe Stunting
BAZ < –2SD	Thinness
BAZ < –3SD	Severe Thinness
BAZ > +1SD	Overweight
BAZ > +2SD	Obesity

BAZ, Body mass index (for age – Z-score); HAZ, Height-for-age – Z-score; WAZ, Weight-for-age – Z-score.

SPSS 15.0 statistical software. Proportions were compared using the chi-Squared test and Pearson correlation (r) was used to assess the direction and strength of the relationship between age and the prevalence of different forms of malnutrition. P values less than 0.05 were regarded as statistically significant.

RESULTS

Prevalence of Malnutrition

The 1,016 children comprised 479 (47.1%) boys and 537 (52.9%) girls.

Four hundred and one (39.4%) had one or more forms of malnutrition (underweight, stunting, thinness, overweight or obesity). Six hundred and fifteen (60.6%) had normal WAZ, HAZ and BAZ. The proportion of boys with malnutrition was significantly higher than that of girls with malnutrition [213 (44.4%) vs 188 (35.0%); $\chi^2 = 9.480$, p = 0.002] As shown in Table 1, the prevalence of malnutrition increased with age from 28.0% at six years to 46.5% at 10 years of age. The prevalence of malnutrition was higher among boys than girls at all ages but this was only statistically significant at nine years of age (p = 0.0001). Using Pearson correlation with age as the independent variable and frequency of malnutrition as the dependent variable, age was strongly and directly correlated with the prevalence of malnutrition with significance for boys (r = 0.90; p = 0.036) and but without significance for girls (r = 0.81; p = 0.09).

Underweight (WAZ < –2SD)

A total of 260 (25.5%) children were underweight. The prevalence of underweight was 30.3% among boys and 21.4% among girls ($\chi^2 = 10.428$, p = 0.001). Similarly, a total of 49 (4.8%) were severely underweight; this occurred among 6.3% of the boys and 3.5% of the girls ($\chi^2 = 4.095$, p = 0.04). For both sexes, the prevalence of underweight increased with age as shown in Table 2. The sex differences were only statistically significant at the age of nine years (p = 0.002). Using Pearson correlation with age as the independent variable and frequency of underweight as the dependent variable, age was also directly and strongly correlated with the prevalence of underweight among boys (r = 0.97; p = 0.006) and girls (r = 0.94; p = 0.014).

Stunting (HAZ < –2SD)

The overall prevalence of stunting was 144 (14.2%) while the prevalence among boys and girls were 16.9% and 11.7% respectively ($\chi^2 = 5.581$, p = 0.018). Severe stunting occurred among 2.9% of the subjects with 3.5% among boys and 2.2% among girls. Although there was no definite trend in the age-specific prevalence of stunting, the prevalence was consistently higher among boys compared to girls at all ages above six years but without statistical significance (Table 3). Using Pearson correlation with age as the independent variable and frequency of stunting as the dependent variable, there was no significant correlation between age and the prevalence of stunting for boys (r = 0.38; p = 0.524) and girls (r = 0.62; p = 0.263).

Thinness (BAZ < –2SD)

Thinness was diagnosed among 226 (22.2%) children. The prevalence rates among boys and girls were 23.8% and 20.8% respectively. This sex difference lacked statistical significance (p = 0.2) The overall prevalence of severe thinness was 51(5.0%), this occurred significantly more frequently among boys compared to girls (6.9% vs 3.3%; $\chi^2 = 6.645$, p = 0.01) The overall prevalence of thinness increased with age and was higher among boys compared to girls at all ages except at age of eight years as shown in Table 4. However, the sex

Table 2: Prevalence of malnutrition by age and sex

	Number (%) Malnourished			
Age(years)	All	Boys	Girls	P-value
6	37 (28.0)	17 (31.5)	20 (25.6)	0.4
7	53 (33.9)	31 (36.0)	22 (31.4)	0.5
8	86 (37.9)	44 (38.3)	42 (37.5)	0.5
9	103 (43.1)	64 (56.1)	39 (31.2)	0.0001
10	122 (46.5)	57 (51.8)	65 (42.8)	0.1
Total	401 (39.4)	213 (44.4)	188 (35.0)	0.002

Table 3: Prevalence of Underweight by Age and Sex

	Number (%) Underweight			
Age(years)	All	Boys	Girls	P-value
6	11 (8.3)	4 (7.4)	7 (8.9)	0.7
7	27 (17.3)	19 (22.1)	8 (11.4)	0.08
8	52 (22.9)	32 (27.8)	20 (17.9)	0.07
9	71 (29.7)	45 (39.5)	26 (20.8)	0.002
10	99 (37.7)	45 (40.9)	54 (35.5)	0.3
Total	260 (25.5)	145 (30.3)	115 (21.4)	0.001

difference was only significant at the age of nine years (p = 0.02). Using Pearson correlation with age as the independent variable and frequency of thiness as the dependent variable, there was strong and direct correlation between age and the prevalence of thinness for boys (r = 0.86; p = 0.062) and girls (r = 0.93; p = 0.02).

Overweight /Obesity (BAZ > +1SD and > +2SD)

The overall prevalence of overweight and obesity were 31(3.0%) and 5(0.5%) respectively. Overweight was commoner among boys compared to girls but the difference was not statistically significant [17/479 (3.5%) vs 14/537 (2.6%); χ^2 = 0.759, p = 0.3]. Similarly, obesity was commoner among girls compared to boys but without statistical significance [4/537 (0.7%) vs 1/479 (0.2%); χ^2 = 1.486, p = 0.2]. Table 5 shows that the combined prevalence rates of overweight/obesity were higher at age six years and eight years. The sex differences with respect to the prevalence of overweight/obesity suggested that overweight/obesity was more common among girls between age 7 and 8 years but without statistical significance. Using Pearson correlation with age as the independent variable and frequency of overweight/obesity as the dependent variable, there was no correlation between age and the prevalence of overweight/obesity among boys (r = 0.02; p = 0.966) but there was a strong but inverse relationship between age and the prevalence of overweight/obesity among girls (r = -0.810; p = 0.09).

Three (16.7%) of the 18 overweight/obese boys were also stunted compared to 5 (27.8%) of the 18 girls. The difference was not statistically significant (χ^2 = 0.643, p = 0.42).

Table 4: Prevalence of Stunting by Age and Sex

	Number (%) Stunting			
Age(years)	All	Boys	Girls	P-value
6	17 (12.9)	10 (8.5)	7 (8.9)	0.1
7	27 (17.3)	18 (20.9)	9 (12.9)	0.1
8	28 (12.3)	16 (13.9)	12 (10.7)	0.4
9	31 (12.9)	18 (14.4)	13 (10.4)	0.2
10	44 (15.6)	19 (17.3)	22 (14.5)	0.5
Total	144 (14.2)	81 (16.9)	63 (11.7)	0.018

Table 5: Prevalence of Thinness by Age and Sex

	Number (%) Thinness			
Age(years)	All	Boys	Girls	P-value
6	13 (9.8)	6 (11.1)	7 (8.9)	0.6
7	29 (18.6)	17 (19.8)	12 (17.1)	0.6
8	45 (19.8)	20 (17.4)	25 (22.3)	0.3
9	65 (27.2)	39 (34.2)	26 (20.8)	0.02
10	74 (28.2)	32 (29.1)	42 (27.6)	0.7
Total	226 (22.2)	114 (23.8)	112 (20.8)	0.26

Table 6: Prevalence of Overweight/Obesity by Age and Sex

	Number (%) Overweight*			
Age(years)	All	Boys	Girls	P-value
6	7 (5.3)	3 (5.5)	4 (5.1)	0.9
7	5 (3.2)	1 (1.1)	4 (5.7)	0.1
8	11 (4.8)	4 (3.4)	7 (6.2)	0.3
9	8 (3.3)	6 (5.2)	2 (1.6)	0.1
10	5 (1.9)	4 (3.6)	1 (0.6)	0.08
Total	36 (3.5)	18 (3.8)	18 (3.3)	0.72

**Combination of Overweight and Obesity.*

DISCUSSION

Close to two-thirds of the children studied had normal nutritional status which is comparable to 65% to 87% reported among Pakistani children.[13] The findings in this study show that the various forms of under-nutrition (stunting, underweight and thinness) occurred more frequently than overweight/obesity in the population studied. However, stunting was the least common form of under-nutrition while underweight was the commonest among children in the present study. Overall, 25.5%, 22.2% and 14.2% were underweight, thin and stunted respectively. A previous similar study conducted in another part of southwest Nigeria using the NCHS tools showed that the prevalence of underweight and stunting (61.2% and 27.8% respectively) were remarkably higher than the findings in the present study.[14] However, the prevalence of underweight in the present study was comparable with 27% and 30% reported from the use of NCHS references in West Bengal, India[15] and Pakistan.[13] Similarly, the prevalence of stunting in the present study was lower than 23% reported among children in West Bengal, India[15] and 35% prevalence reported among the aforementioned Pakistani children.[13]

Interestingly, the prevalence of underweight and stunting in the present study were also comparable with a more recent finding from Karachi, Pakistan

where 27.3% and 14.3% school-aged children had underweight and stunting respectively.[16] In Tanzania,[17] the pattern was remarkably different because the prevalence of both stunting and underweight were higher (52.5% and 43% respectively) than what obtained in the present study. Similarly, the prevalence of stunting and underweight among Malaysian children[18] (6.7% and 7.1% respectively) determined with the NCHS standards were remarkably lower than the findings in the present study.

The wide range of prevalence rates described above may be attributed to differences in epidemiological factors as well as differences in the diagnostic tools used in the various studies. All the previously cited studies were carried out using the NCHS references and other similar references derived from affluent societies in Europe. The new WHO reference values used for the present study is more widely applicable and had been projected to diagnose various forms of under-nutrition and overweight to variable extents from what was previously known with the NCHS references.[9]

It is of interest, overweight and obesity appeared uncommon in the present study since their prevalence were 3.0% and 0.5% respectively. Indeed, available literature suggests that till date, overweight and obesity are not common nutritional problems among Nigerian school children.[19] Even a more recent report from Lagos, Nigeria showed a prevalence of overweight and obesity ranging between 3.0% and 3.7% as well as between 0% and 0.4% respectively in 2007.[7] Nevertheless, these Nigerian observations were in tandem with reports of a prevalence of 3.3% for overweight among Ethiopian children using the NCHS standards.[20] Instructively, the present findings were in spite of the expectations that the WHO standards would diagnose overweight and obesity more frequently than the NCHS standards.[9] The emergence of overweight/obesity as nutritional disorders in under-resourced parts of the world like Nigeria is worrisome.

Sex differences were also observed in the nutritional status of the children studied. Underweight and thinness were more frequent among the boys compared to the girls in the present study thus suggesting that the girls were generally better nourished. The reason for this is unclear as it disagrees with the culture of sex preference in favour of the boy child in this part of the world. Interestingly, there was no significant sex difference in the prevalence of overweight and obesity in the present study. This agrees with the findings among Italian school-aged children where overweight and obesity also had no sex predilection. [21]

CONCLUSION

The prevalence of malnutrition among school children in Sagamu, Nigeria was high. This necessitates both short-term and long-term corrective measures like nutritional surveillance and specific nutritional intervention programmes like the introduction of compulsory but free mid-day school meals as a fiscal policy of the government. Health promotion to improve nutrition culture in the communities is also important.

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