Prevalence of Overweight and Obesity among School-age Children in Mainland Local Government Area, Lagos State

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ABSTRACT

Background: Obesity is now an emerging public health challenge in Nigeria, because of changing lifestyle. However, there are variations on the reported prevalence of obesity. This study determined the prevalence of overweight and obesity among school children in Mainland Local Government Area, Lagos.

Materials and Method: A cross-sectional survey among children seen at primary schools in Mainland Local Government Area, Lagos State. Socio-demographic and anthropometric data were collected. BMI-for-age and sex Z-scores were determine and used to classify overweight/obese children.

Results: A total of 340 pupils with a mean age of 8.61 ± 2.2 years were enrolled in the study. The majority were male (53.3%), from low socio-economic class (53.4%), and had low physical activity (58.89%). Thirty-four pupils (10.2%) were either overweight (6.9%) or obese (3.3%). The mean BMI (kg/m2) of the female pupils was 20.53 ± 1.51while that of the male pupils was 19.81 ± 1.43 ($p = 0.002$)

Conclusion: The prevalence of Overweight/Obesity of 10.2% among the school pupils was relatively high confirming the reported emerging trend in low-income countries like Nigeria. The majority of the Pupils had low physical activity levels. Activities promoting weight loss are recommended to prevent the emergence of the obesity epidemic.

INTRODUCTION

Obesity, a form of malnutrition, is an excessive adiposity accumulation that presents a health risk (1). Over 390 million children and adolescents aged 5–19 years were overweight in 2022. The prevalence of overweight (including obesity) among children and adolescents aged 5–19 has risen dramatically from just 8% in 1990 to 20% in 2022. nearly one in three school-aged children are living with overweight or obesity(2).

Malnutrition comprises undernutrition (wasting, stunting, underweight, vitamins or minerals deficiencies) and overnutrition (obesity). These two types of malnutrition affect a significant percentage of the world population and can coexist in a population (3,4). However, this study focused on overweight and obesity in children, which signifies a fast-growing risk to the health of individuals in an

increasing number of countries. The consequences of obesity have become a challenge similar to that of undernutrition, which has been shown to trail into adulthood (5). Childhood obesity is a significant determinant of adult obesity, with other health consequences (6,7).

Over half of obese children turn out to become obese adults compared to only one-tenth of non-obese children who eventually become obese adults (8). Timely institutions of strategies for childhood obesity prevention will not only reduce morbidity and mortality in children but will also protect adults from becoming obese in the future. Childhood obesity thus poses a significant threat to public health globally, affecting both developed and underdeveloped countries.

Body mass index (BMI) is a weight-for-height metric

widely employed to categorize overweight and obesity in adults, calculated by dividing an individual's weight in kilograms by the square of their height in meters (kg/m2) (9). WHO designates a BMI equal to or exceeding 25 as indicative of overweight, while a BMI of 30 or higher signifies obesity (10). In this study, primary school pupils in grades 1 to 6, aged 5 to 13 years, were the focus, with childhood obesity defined as a weight significantly surpassing the average for a child's height and age (11).

In assessing children and adolescents (individuals under 18), BMI is age-specific and termed BMI-for-age. Consequently, a meaningful interpretation of BMI in children necessitates comparison to a reference standard based on age and sex. For children, BMI z-scores, also known as BMI standard deviation (SD) scores, are utilized as indicators of relative weight adjusted for the child's age and sex. Accordingly, BMI-for-age < (-2) Z scores denote underweight; (-2) to < (+1) Z scores signify normal weight; +1 to < (+2) Z scores indicate overweight, and > (+2) Z scores are indicative of obesity (12).

Obesity, once regarded as primarily a concern in developed nations, is now becoming increasingly prevalent in developing countries, including Nigeria, due to shifting lifestyle patterns (13). A significant contributing factor is the growing inclination of families, teenagers, and young adults toward dining outside the home. Additionally, a discernible trend of adopting sedentary lifestyles, marked by a lack of physical activity and a tendency to lead affluent lives, contributes to the surge in obesity rates. The prevalence of obesity among Nigerian children under five years old has shown a consistent increase over time, as documented in the Nigeria Demographic and Health Survey (NDHS) of 2018 (14). Obesity affects the physical, emotional, and social well-being of children and their school performance, which ultimately causes a significant reduction in their quality of life (15,16,17).

In Nigeria, while there is available information on the prevalence of obesity in adults and, to a limited extent, in children, there is a notable gap in current data regarding the prevalence and patterns of overweight and obesity among primary school children (18). Addressing this gap is crucial for developing context-specific interventions to prevent obesity and its associated consequences. Practical strategies for preventing and managing obesity necessitate understanding the prevailing conditions and the actual burden of obesity in the targeted population.

Until recently, childhood malnutrition in low-income settings was primarily called childhood undernutrition (19). However, a paradigm shift is evident as Nigeria now experiences a double burden of obesity and undernutrition (20). Childhood obesity emerges as a significant public health challenge, not only acting as a potent risk factor for adult obesity and its complications but also contributing to substantial morbidity and mortality in childhood (21), which includes adverse effects such as reduced years of schooling, diminished economic productivity, and an elevated risk of certain chronic diseases (15). Historically, childhood undernutrition has posed a more substantial and persistent challenge in Nigeria than overnutrition (22).

However, recent observations suggest a changing landscape, with a mixed picture of undernutrition and overnutrition emerging in the last decade (15). In a study conducted in Sokoto, (15) a mixed prevalence of undernutrition (31.3%) and obesity (23.4%) among school children was reported, indicating a complex nutritional scenario.

Despite Lagos State being cosmopolitan, significant populations in urban slums exhibit high incidences of undernutrition and obesity among children. Recent studies from Lagos state have revealed an escalating burden of obesity, reaching up to 40.1% (23). This concerning trend is exacerbated by a lack of understanding of the environmental factors contributing to these patterns.

The current study was undertaken to bridge these knowledge gaps and investigate the prevalence of overweight and obesity among primary school pupils in the Mainland Local Government Area, Lagos State, Nigeria. The findings aim to inform the planning of a school-based nutrition intervention program in the state and, by extension, contribute to addressing nutritional challenges in Nigeria.

MATERIALS AND METHODS
Study Area
This study covered the prevalence of overweight and obesity among children attending registered primary schools in Mainland LGA, of Lagos State. Mainland LGA is in the Lagos administrative divisions of Lagos State and is a mix of settlements of people from different parts of Nigeria. It has a major urban slum, and coincidentally the technology, medical research, and educational hubs of Lagos and Nigeria. It is one of the most densely populated areas in Lagos State with a population of over 500,000 people according to the 2006 Nigerian census, with the area hosting members of diverse ethnic affiliations. The Yoruba and pidgin English languages are commonly spoken in Lagos

mainland LGA while the religions of Christianity and Islam are widely practiced in the area. It is a mix of residential, commercial, and industrial areas. It is home to several major educational institutions such as the University of Lagos, Yaba College of Technology, and Federal Science and Technology College. This study is delimited to pupils from private and public primary school, from classes 1 to 6, and aged 5-13 years.

Study Design
The study employed a cross-sectional study design.

Study Population and Sample Size Determination
The study population comprised 42,956 children from public and private primary schools in Lagos Mainland Local Government Area, Lagos. The sample size for the study was calculated using the Cochran formula (24). The sample size consists of 296 children from public and private primary schools. Therefore,

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

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 a 95% confidence interval);

p = the proportion in the target population estimated to have a particular characteristic. (Obesity Prevalence rate of 26.0% (0.26) among Primary School Children in Lagos, Nigeria. (Ogbo et al., 2014).

q = $1.0 - p$;

d = degree of accuracy desired; set at 0.05

Therefore, the minimum sample size

$$n = \frac{(1.96)^2 (0.26)\,(0.74)}{(0.05)^2} = 296$$

As a non-response rate of 15% was anticipated, the sample size was increased by 44. The final sample size for the study was 340.

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Sampling Techniques
A multi-stage sampling method was employed.
Stage 1: Selection of Mainland LGA from a list of the 21 LGAs in Lagos State through simple random sampling by ballot.

Stage 2: A list of registered primary schools in Mainland LGA was obtained from Lagos Schools Online (25), the official internet portal for all schools in Lagos State hosted by the Lagos State government. The ratio of public to private schools in the study area was 1.5:1, therefore 6 public schools and 4 private schools were selected for the study. Thus, a total of 10 schools were selected for the study using simple random sampling.

Stage 3: In the next stage, the number of pupils selected from each school was determined using the Neymann allocation formula for stratified sampling. For each school,

$$n_i = \frac{n N_i \sigma_i}{\sum N_i \sigma_i}$$
$$i = 1,2,3, \dots \dots \dots K$$
$\sigma_i = Standard\ deviation\ ith\ stratum$
$N_i = ith\ stratum\ size$
$n_i = ith\ sample\ size$

The allocated sample size for each school was proportionately divided among sections, and the total number of pupils in each section formed the sampling frame. This allotted sample was further divided based on the number of classes in each section.

Stage 4: The sample size for each school was divided among the sections, and the total number of pupils in each section was further divided based on the number of classes in each section. In each selected class, participants were chosen using systematic random sampling from the class register until the required number for the class was achieved. The process involved:
·Determine the interval size (k) by dividing the number of pupils in the class register by the allotted sample size (n).
·Select a random number from the class register within the first n.
·Continue to select every kth number after the initial random selection until the allotted sample size for the class is completed.

Instrumentation and Data Collection Method
Study-related information was obtained using a data collection form containing pre-tested questionnaire sections and an anthropometry measurement data entry section. The data collection form consists of three sections: Section A (socio-demographic questionnaire), Section B (physical activity and leisure activity questionnaire), and Section C (anthropometry measurement form). The

pupils were handed over section A (socio-demographic data) by their teachers to enable parents/guardians to assist them in completing it at home, which also acts as parental consent to be part of the study. The researcher and trained research assistants obtained information on pupils' physical activity using a pre-tested questionnaire (Section B). In Section C (Anthropometric measurement form), a Salter magnifying mechanical scale was used to measure the weight of the children wearing light clothing, and a stadiometer wall-mounted height measure was used to measure the height of the children, barefooted.

Ethical Approval and Informed Consent

Before the commencement of the study, ethical clearance was obtained from the Institutional Review Board (IRB) of the Nigerian Institute of Medical Research, Lagos; the Parents-Teachers -Forum and the Lagos State Ministry of Education. The research protocol adhered to the ethical guidelines outlined in the Declaration of Helsinki and relevant national regulations concerning research involving human subjects. The approval process included a thorough review of the study design, participant recruitment methods, and data collection procedures to protect participants' rights, welfare, and confidentiality.

Informed consent was obtained from all participating children's parents or legal guardians. A detailed information sheet outlining the purpose, procedures, potential risks, and benefits of the study was provided to the parents/guardians. The information sheet was available in both English and Local languages (Yoruba and Igbo), and it included contact information for the principal investigator and the IRB in case of any questions or concerns.

Data and Statistical Analysis

Each pupil's recorded weight and height measurements were converted into nutritional indices. The BMI was calculated as the body weight ratio (kilograms) to the square height (in square meters). To classify pupils into underweight, normal weight, overweight, or obese categories, BMI-for-age and sex (BAZ) Z scores were computed using the WHO (12) guidelines. BMI z-scores, also known as BMI standard deviation (SD) scores, provide a relative weight adjusted for age and sex, indicating the deviation between the child's value and that of the reference population. While percentiles may be convenient for interpretation, the WHO recommends using Z-scores for consistency and comparability across studies.

The social class of parents in this study was determined based on the classification proposed by (26). This classification stratified social class into five categories using parents/guardians' levels of education and occupation, with scores assigned to each child according to the occupation of the father/guardian and the educational attainment of the mother/guardian.

Data entry and analysis were conducted using the Statistical Package for Social Sciences (SPSS) version 21.0. Categorical variables were presented through frequency distribution tables, while summary statistics were generated for discrete variables. Means were compared using Student's t-test, and rates, ratios, and proportions were assessed using the Chi-Square test. Yates correction for Chi-Square was applied when expected values in cells were less than five.

RESULTS

A total of 340 pupils were used in this study. However, five pupils did not return the section on the socio-demographic data questionnaire and were excluded—the remaining 335 (98.0%) pupils with complete information were used for analysis. The statistical analysis of the data collected from the study is presented below.

Socio-demographic characteristics of primary school children

Table 1 shows that the ages of the participants ranged from 5 to 13 years, with a mean of 8.61 ± 2.2 years. Over two-thirds of the children were under eleven (78.5%). Most participants were males (53.3%) and from low socio-economic households (53.4%). About two-thirds of the participants were living with their biological parents (70.4%), practiced Christianity (62.4%), and were in class three and above (71.3%).

Table 1: Socio-demographic Characteristics of the study participants

Characteristics	Number of the participants n = 335 (%)
Sex	
Male	185(53.3)
Female	150(46.7)
Age group(years)	
5 – 7	129(38.5)
8 – 10	134(40.0)
11 – 13	72(21.5)
Mean age	8.61 ± 2.2 years
Socio-economic class	
Upper (I)	53(15.9)
Middle (II)	103(30.7)
Lower (III)	179(53.4)
School Class of study	
1 – 2	96(28.7)
3 – 4	132(39.5)
5 – 6	107(31.8)
Pupil's Guardian	
Parent (s)	236(70.4)
Grandparent(s)	35(10.4)
Relatives	32(9.6)
Non-Relative	32(9.6)

Table 2: Anthropometric Characteristics of the study participants

Anthropometric measurements	All	Sex		t value	P value
		Male	Female		
Mean Height(M)	1.33ê0.12	1.32ê0.23	1.35ê0.31	21.7	0.24
Mean weight (Kg)	36.52ê9.41	34.53ê6.27	37.42ê9.41	4.714	<0.001
Mean Body mass Index (kg/m$^{2)}$)	20.13ê2.86	19.81ê 1.43	20.53ê1.51	9.23	0.002

Table 2 shows the anthropometric characteristics of the study participants. The pupils' height ranged from 1.01 to 1.64 meters, with a mean of 1.330.24 meters. The mean height of the female pupils (1.35 ± 0.31) was higher than that of the male pupils (1.32 ± 0.23), however, the difference was not statistically significant (P = 0.24). The weight of the pupils ranged from 19 to 76 kg with a mean of 36.529.41kg. The female pupils (37.42 ± 9.41 had higher mean weight than male pupils (34.53 ± 6.27) and the observed difference was statistically significant (p < 0.001). The pupils' BMI ranged from 7.8 to 26.4 kg/m2, with a mean of 20.132.86 kg/m2. The mean BMI for female pupils was significantly higher than that for male children (p = 0.002).

Prevalence of Obesity among Primary School Children

The prevalence of obesity among primary school children is shown in Figure 1. The result showed that twenty-three (6.9%) and eleven (3.3%) participants, respectively, were overweight and obese (overnutrition; 10.2%). The remaining 301(89.9%) participants were either underweight (21.2%) or of normal weight (68.7%).

Physical activity characteristics of the children in primary school

The physical activity characteristics of the children in primary schools are represented in Table 3.
The result showed that the majority of the participants walked to and from school (57.6%),

played video and computer games for less than 2 hours per week (70.2%), watched television for about 2 hours or less per day (52.2%) and slept for more than 9 hours per day (65.1%). The overall mean physical activity score was 2.770.54. More than half of the participants (58.8%) did not meet the physical activity recommendation.
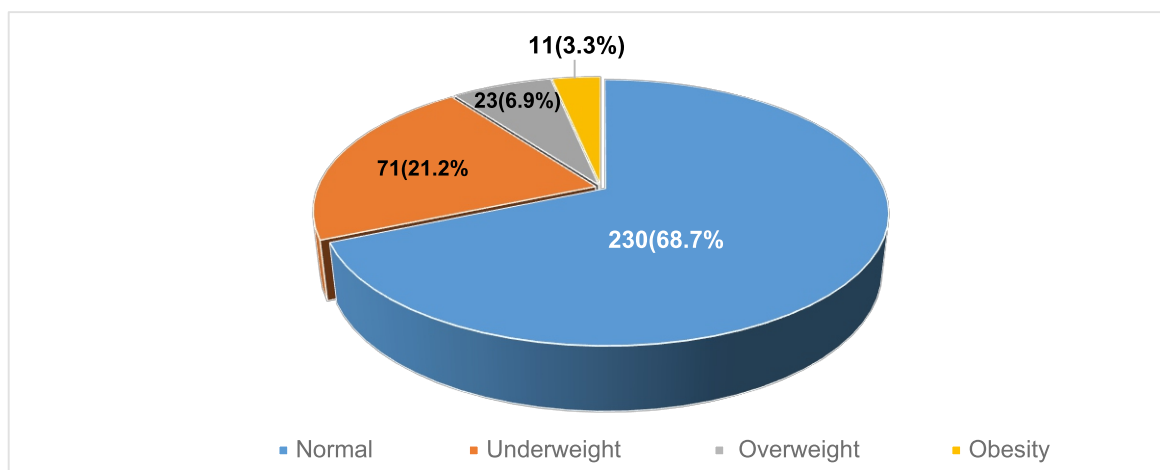

Figure 1: Pie Chart showing the prevalence of obesity among primary school children

Table 3: Distribution of Physical Activities Characteristics of Participants

Physical activity	Overall n=335(%)	Chi square	p value
Mode of transportation to/from school			
ñ Walking	195(57.6)	8.394	0.0038
ñ Motorized	142(42.4)		
Playing video/computer games			
ñ No/rarely	140(41.8)	1.651	0.199
ñ < 2 times a week	95(28.4)		
ñ >2 times a week	100(29.8)		
TV watch duration			
ñ 2 hours or less per day	175(52.2)	0.405	0.504
ñ More than 2 hours per day	160(47.8)		
Sleep duration			
ñ 9 hours or less per day	117(34.9)	0.0054	0.941
ñ More than 9 hours per day	218(65.1)		
Mean physical activity	2.77ê0.54	5.211	0.004
Physical activity levels			
ñ Low	65(19.4)	4.336	0.038
ñ Moderate	131(39.1)		
ñ High	139(41.5)		
Meeting physical activity guide			
ñ No	197(58.8)		
ñ Yes	138(41.2)	7.593	0.006

Sociodemographic and physical activity determinants of overweight/obesity in the study population

Table 4 shows the Sociodemographic and physical activity determinants of overweight/obesity of the participants. The study identified associations between overweight/ obesity, physical activity, and active transportation to and from school. The result showed that participants who were driven to and from school were more overweight and obese (61.8%) compared to those who walked to and from school (38.2%). Participants with low physical activity levels had a higher prevalence of overweight and obesity (44.1%) compared to those with moderate (29.4%) and high (26.5%) physical activity levels.

DISCUSSION

The study included school pupils aged 5-13 years with the males making up the majority at (53.3%). Most of the pupils were at least 8 years old (61.5%), in primary three (3) and above (71.3%), from a low socioeconomic background (53.4%), and lived with their parents (70.4%). These results align with previous research conducted in Sokoto, Abakaliki, and Benin City (15, 27, 28, 29) focusing on primary school children in Nigeria. This consistent pattern reveals a higher representation of male pupils in the upper classes, those living with parents, and individuals from low socioeconomic status. The

observed increase in obesity is likely attributed to nutrition transition rather than socio-demographic factors, considering the prevailing characteristics of children in primary schools nationwide (15).

The study found that the overall prevalence of overweight and obesity was 10.2%, which is consistent with the range of 10.1% to 17.4% reported by previous studies conducted in Benin City and Lagos State (30,31). In comparison, the prevalence of obesity in this study was lower than the 40.1% reported in Lagos State (23), but higher than rates previously documented in some sub-Saharan African countries such as South Africa, Tanzania, and, Burkina-Faso (32, 33, 34). These results highlight the increasing problem of overweight and obesity among school children, not only in Nigeria but across Sub-Saharan Africa. These findings are in line with the ongoing Nutrition transition in Nigeria and other low and medium-income countries. Therefore, it is imperative to implement early preventive strategies for overweight and obesity in childhood rather than delaying intervention until adulthood, given that these conditions are prevalent among school children, as demonstrated by the present study and other studies.

As observed in this study, the coexistence of overnutrition and undernutrition in the same population echoes previous reports in Nigeria (35,3), which underscores the complexity of

Table 4: Sociodemographic and physical activity determinants of overweight/obesity in the study population

Variable	Nutritional status		COR 95% CI	P value	AOR 95% CI
	OW/OB	Not OW/OB			
Sex					
Male	15(44.1)	170(56.5)	1.0		-
Female	19(55.9)	131(43.5)	0.98(0.48-1.99)	1.00	-
Socioeconomic class					
Upper (I)	10(29.4)	43(14.2)		0.24	-
Middle (II)	11(32.4)	92(30.6)	1.9(0.81-3.46)		-
Lower (III)	13(38.2)	166(55.2)	1.0	0.44	-
Transport to/from school			0.66(0.28-1.52		
Walking	13(38.2)	182(60.1)			1.0
Motorized	21(61.8)	121(39.9)	1.0	0.02	1.91(1.23-4.67)
Physical activity levels			2.43(1.17-5.04)		
Low	15(44.1)	50(16.9)		0.02	2.35(1.54-6.13)
Moderate	10(29.4)	121(39.9)			1.0
High	9(26.5)	130(43.2)	3.15(1.29-7.62)	0.89	-
			1.0		
			0.84(0.33-2.13)		

malnutrition, where underweight, overweight, and micronutrient deficiencies may coexist within a community undergoing a nutrition transition (36). To address this multifaceted challenge, a comprehensive approach involving food-based plans that promote diverse nutrient intake is crucial.

The relatively high levels of overweight and obesity observed in this study and other Nigerian studies may be influenced by factors such as location, type of school, and socio-economic status (28). As seen in this study, the double burden of malnutrition poses health implications and requires thoughtful policy and program planning (4).

Declining physical activity among school children and increased sedentary behaviors like TV watching and playing video games align with global trends (37, 38). In this study, most participants did not meet physical activity recommendations (58.89%), engaged in video games at least two times per week (29.8%), and watched television for more than 2 hours daily (47.8%). High physical activity levels among children from lower economic strata may be attributed to more energy-intensive domestic tasks, while affluent children may experience sedentary lifestyles (38). Children from high socio-economic households are likely to have access to technology, hence resulting in a more sedentary lifestyle (39).

The study identified associations between overweight or obesity, physical activity, and active transportation to and from school. These findings align with a multi-country study suggesting that active transport to school correlates with meeting physical activity recommendations and a lower likelihood of being overweight or obese (40).

A significant strength of this study is the objective measurement of weight and height by the researchers as opposed to parents /guardian-reportedanthropometric data. The employment of the PAQ-C, a validated tool for physical activity assessment, adds robustness to the findings (40,41). Although the study was conducted in a cosmopolitan city and an urban local government area, limiting generalizability to the entire country, the observed high prevalence of overweight and obesity underscores a nationwide health concern. The cross-sectional design and reliance on self-reported data from children introduce inherent limitations, such as recall bias and misreporting.

Despite these limitations, the study's findings align with existing literature on childhood obesity and overweight, emphasizing the urgent need to address this emerging health challenge in Nigeria.

CONCLUSION

This study revealed a 10.2% prevalence of overweight and obesity among primary school children in Mainland LGA, Lagos State, consistent with similar findings in other studies. These results point to noteworthy shifts in Nigerian school children's socio-economic and socio-demographic landscape, indicating a trend towards lifestyle behaviors characterized by reduced physical activity, heightened sedentary habits, and the adoption of unhealthy dietary patterns. Additionally, the investigation identified motorized transportation to and from school, along with low-level physical activity, as significant determinants contributing to overweight and obesity among school children in urban Nigeria. These findings underscore the evolving health challenges associated with changing lifestyles in the context of urbanization and shifting socio-economic dynamics.

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