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Pattern and predictors of overnutrition among adolescents in rural areas of Ogun State, Nigeria

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Abstract
Objective: Overnutrition is a risk factor for major Non-Communicable Diseases globally. Adolescence is a vulnerable period characterised by several lifestyle changes such as a newly discovered autonomy and peer pressure which may result in them adopting long-lasting unhealthy behaviours that could lead to overnutrition. This study was carried out to assess the pattern and predictors of overnutrition among adolescents in rural areas of Ogun State, Nigeria.
Methods: This was a school-based descriptive cross-sectional study carried out between July and October 2023 among 898 in-school adolescents. A multi-stage sampling technique was applied to select respondents for the study. A pretested, self-administered questionnaire was used to obtain information from the participants. A binary and multivariable logistic regression model was fitted with adjusted odds ratio and 95% confidence levels. Statistical significance was taken at P<0.05.
Result: The mean age of respondents in this study was 15.40±1.91 years. There were more females (51.8%) than male respondents (48.2%). The mean weight was 48.56±9.78kg, and the mean BMI was 19.19±3.23. The prevalence of overnutrition was high (16.4%). The predictors of overnutrition were age (AOR=0.448, 95%CI= 0.217-0.925), gender (AOR=0.467, 95%CI= 0.311-0.703), father's occupation (AOR=2.505, 95%CI= 1.229-5.105), mother's education (AOR=2.167, 95%CI= 1.252-3.751) and level of physical activity (AOR=0.269, 95%CI= 0.074-0.983).
Conclusion: The prevalence of overnutrition among adolescents in Ogun State is high. Efforts should be geared towards the introduction of nutrition education programmes that address the factors associated with overnutrition. Furthermore, policies on obesity-preventing measures in the form of increased physical activity in high schools should be implemented.

Keywords: Adolescents, Obesity, Overnutrition, Physical inactivity, Rural

Plain English Summary
Overnutrition is a major risk factor in the development of non-communicable diseases like diabetes mellitus, cardiovascular diseases, and cancer. It is particularly important in the adolescent age group where several lifestyles change peculiar to the age group make them adopt long-lasting unhealthy behaviours that could lead to overweight and obesity. This study sets out to assess the pattern and factors associated with overnutrition among adolescents in rural areas of Ogun State, Nigeria.
The average age of respondents in this study was 15.40±1.91years. More female, than male respondents participated in this study. The mean weight was 48.56±9.78kg, and the mean BMI was 19.19±3.23. The prevalence of overnutrition was high (16.4%). The factors associated with overnutrition

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among respondents were age, gender, father's occupation, mother's education and level of physical activity. In conclusion, the prevalence of overnutrition among adolescents in Ogun State was high. Efforts should be geared towards the introduction of nutrition education programmes that will address the factors associated with overnutrition. In addition, policies on obesity prevention measures in the form of increased physical activity in high schools should be implemented.

Background

Overnutrition is a term that depicts a combination of obesity and overweight. It is a form of malnutrition in which calorie intake surpasses expenditure for normal growth and development, leading to excessive fat accumulation that presents a health risk to an individual. In adolescents, it is characterized by body mass index (BMI) for age z score above one (1). It is a global public health challenge among adolescents in both developed and developing worlds, and a risk factor for chronic diseases like diabetes mellitus, cardiovascular diseases, and cancer. Overnutrition affects an estimated 10% of adolescents globally (2).

The increasing prevalence of overnutrition among the adolescent age group (10-19 years), could be due to their lifestyle changes within this transition period (3, 4). Adolescence is a vulnerable period characterised by major lifestyle changes such as a newly discovered autonomy and peer pressure may result in adopting long-lasting unhealthy behaviours that could lead to overweight and obesity. This increasing prevalence of obesity has led to increased occurrence of early-onset obesity-related diseases. A joint report by the WHO/FAO states that 60% of overweight children have added risk factors for cardiovascular diseases such as hypertension, and hyperinsulinemia; while obese children are at increased risk of Type 2 DM which in turn are associated with higher chances of premature deaths and disability (5). Other consequences of obesity are psychological effects and social stigma faced by obese adolescents, which can have serious consequences for mental and physical health (6). Adolescent overnutrition, formerly associated with wealth, has now become an emerging public health problem in countries in sub-Saharan Africa. Globally, in 2010, about 42 million children were overweight with 35 million living in developing countries (7). Studies conducted among school-aged adolescents in sub-Saharan Africa found the prevalence of overweight and obesity to vary between 2.1 to 18.7% (8, 9, 10). Childhood and adolescent obesity are strong predictors of adult obesity which has now become the public health challenge of the 21st century according to the World Health Organisation (WHO) (11). Though there has not been any national survey on overweight and obesity among adolescents in Nigeria, some studies however have been done in the country.

A systematic review of data on child and adolescent obesity in Nigeria spanning three decades showed a prevalence of 1.0–8.6 per cent of overweight and 0.0–2.8 per cent of obesity (12). A similar study done in Kano Nigeria, showed the prevalence of overweight and obesity in adolescents to be 1.98 and 0.84 percent, respectively (13).

Many low- and middle-income countries are now facing a "double burden" of malnutrition. While these countries continue to deal with the problems of infectious diseases and undernutrition, they are also experiencing a rapid upsurge in non-communicable disease risk factors such as obesity and overweight, particularly in urban settings (2). It is not uncommon to find undernutrition and obesity co-existing within the same country, the same community and the same household. Children in low- and middle-income countries are more vulnerable to inadequate pre-natal, infant, and young child nutrition. At the same time, these children are exposed to high-fat, high-sugar, high-salt, energy-dense, and micronutrient-poor foods, which tend to be lower in cost but also lower in nutrient quality. These dietary patterns, in conjunction with lower levels of physical activity, result in sharp increases in childhood obesity while undernutrition issues remain unsolved (14, 15).

A better understanding of the pattern and predictors of overnutrition among adolescents is very important in reducing the morbidity and mortality associated with overnutrition. In Nigeria, the adolescent population compared to other age groups is high and is expected to increase in the future (16). Despite this, adolescent nutrition receives very little attention; a lot of interventions focus on their reproductive health issues. And most diet-related studies conducted in this age group were mostly on undernutrition (17). Furthermore, no study has assessed the pattern and predictors of overnutrition among adolescents living within the rural areas of Ogun State, Nigeria.

Materials and Methods

This study was carried out in Ogun-East Senatorial district; one of the three senatorial districts in Ogun State, Nigeria. Ogun State is one of the 36 States in Nigeria. The district has a population of 1,485,506 inhabitants projected from the 2006 census figure (NPC,2006) (16). The predominant tribe is Yoruba with Ijebu and

Remo people in the majority. Their main occupations are petty trading, farming and white-collar jobs (16). Ogun-East Senatorial district is predominantly rural with six out of the nine local government areas (LGAs) being rural. There are several educational facilities in the state including primary, secondary, and tertiary institutions. There are one hundred and ninety- nine government-owned secondary schools in the Senatorial district.

This descriptive cross-sectional study was conducted between July and October 2023 among adolescents attending selected public secondary schools in rural areas of the Ogun-East Senatorial district. In-school adolescents who have been residing fully within the rural areas of the Ogun-East Senatorial district for at least one year were included in the study, while adolescents with chronic medical conditions or who are physically impaired were excluded from the study.

The sample size was obtained from the formula for descriptive studies (18) using a prevalence of 45% for high body fat from a previous study (19). A sample size of 460 was calculated allowing for 20% non-response. This was further rounded up to a sample size of 900.

A multistage sampling method was used to recruit the study participants. The nine LGAs in the Ogun-East Senatorial district were stratified into urban and rural LGAs; three urban and six rural. Simple random sampling, by use of the balloting method, was used to select three schools from each rural LGA. Proportion to size allocation was used to calculate the number of participants from each school. It was immediately followed by stratification of students per class level and proportionate allocation of respondents per level. The final stage involved the selection of respondents (based on the allotted number per class) by systematic sampling.

Data collection was done using a semi-structured, self-administered questionnaire adapted from similar studies (20, 21). The questionnaire was divided into three sections; the first contained questions relating to the socio-demographic characteristics of the respondents, the second contained measures of anthropometric indices, and the third contained questions assessing the lifestyle choices and physical activity patterns of participants.

Anthropometric measurements, including weight and height, were obtained. A digital electronic weighing scale was used to measure the participant's weight (in kilogram) to the nearest 0.1kg. Body weight was measured with the student's shoes and belt off and on light clothing. The students' weights were taken twice to ensure accuracy and average weights were determined. An upright portable stadiometer was used for measurement of the participants' heights to the nearest 0.1m while the participants were in a standing position with their back on the stadiometer and the shoes off, looking straight ahead.

The measurements obtained from the height and weight were entered into the Anthroplus software to determine the BMI of the student using WHO (2007) BMI for age and sex cut-offs (Appendix VII and VIII. BMI was categorized into: underweight (<15th percentile), normal weight (15th to <85th percentile), overweight (85th to <97th percentile), and obese (≥97th percentile) (22) and each category of the BMI for age was expressed as percentages to determine the prevalence of overweight and obesity.

The physical activity patterns of the respondents were assessed using the physical activity questionnaire for older children and adolescents by Kowalski (20). This is a modification of the Physical Activity Questionnaire for Adolescents (PAQ-A) and has been validated and used to assess the physical activity level of adolescents in Nigeria (21).

It is a 7-day recall instrument, and it includes physical activities that are common with Nigerian adolescents both at school and leisure time. The modified PAQ-A had 9 questions out of which eight questions were used to calculate the physical activity level of the respondents. The first question had a list of activities and frequency in the last seven days, while questions 2−8 assessed the type of activity/intensity. All questions were given scores of 1, 2, 3, 4 or 5. For the first and last items in the questionnaire, the mean of all activities, and the mean of all days of the week are used to calculate the composite score respectively. To calculate the final PAQ-A activity summary score, we took the mean of the scores of the 8 items. A score of 1 indicates low physical activity, 2-4 indicates moderate activity and a score of 5 indicates high physical activity.

The questionnaire was pre-tested on 90 in-school adolescents in two schools in Ogun-West Senatorial District. These two schools have similar characteristics as the schools used in the study. The research instrument was then adjusted before they were finally used for this study to minimize errors. Three research assistants with a working knowledge of the local language were trained to collect data and on how to take the anthropometric measurements.

Data collected were checked for errors and cleaned and then entered into Statistical Package for Social Sciences (SPSS) Version 23.0 for analysis. Data were calculated and presented using means, standard deviation, and proportions. The chi-square test was used to determine the association between categorical variables. Multivariate analysis was done using

logistic regression to identify predictors of overnutrition. Variables that were at the level of significance of P <0.2 at bivariate analysis, were included in the logistic regression model. The level of significance was set at a 95% confidence interval with a P value ≤ 0.05.

Results

Socio-demographic characteristics of respondents (Table 1)

A total of 898 in-school adolescents participated making a response rate of 99.7%. More than half (55.2%) of the adolescents were mid-adolescents (age range of 14–16 years). The mean age of respondents was 15.40±1.91 years Majority of respondents (91.3%) were from the Yoruba ethnic group. Respondents reported that 39.5% of their fathers, and 57.3% of their mothers were traders.

Table 1: Socio-demographic characteristics of respondents

Variables	Frequency	Percentage
Age group (years)		
10-13	143	15.9
14-16	496	55.2
17-19	259	28.9
Mean age	15.40±1.91	
Gender		
Male	433	48.2
Female	465	51.8
Religion		
Christianity	638	71.0
Islam	237	26.4
Traditional	23	2.6
Ethnicity		
Yoruba	820	91.3
Hausa	9	1.0
Igbo	61	6.8
Others	8	0.9
Father's Occupation		
Skilled	431	48.0
Semi-Skilled	74	8.2
Unemployed	33	3.7
Trading	355	39.5
Unskilled	5	0.6
Mother's Occupation		
Skilled	283	31.5
Semi-Skilled	50	5.6
Unemployed/Housewife	49	5.5
Trading	515	57.3
Unskilled	1	0.1
Father's highest level of education		
No formal education	49	5.5
Primary Education	47	5.2
Secondary Education	457	50.9
Tertiary Education	345	38.4
Mother's highest level of education		
No formal education	45	5.0
Primary Education	49	5.5
Secondary Education	481	53.5
Tertiary Education	323	36.0

Table 2 shows anthropometric measurements of respondents The mean weight was 48.56kg±9, and the mean height was 1.59m±0.10. The mean BMI was 19.19 kg/m^2±3.23. BMI of respondents were categorized into four groups, underweight, normal, overweight and obese. Most respondents were in the normal category, while 12.8% were overweight, and 3.6% were obese.

Table 2: Anthropometric measurements of respondents

Variables	Frequency (n-898)	Percentage
Weight (kg)±SD	48.56±9.78	
Height (m)±SD	1.59±0.10	
BMI (kg/m^2)		
Underweight	106	11.8
Normal	645	71.8
Overweight	115	12.8
Obese	32	3.6
Mean (kg/m^2) ± SD	19.19±3.23	

Table 3 shows the lifestyle choices of respondents Most respondents (74.8%) snacked in the past 7 days, though most snacked for 2 days or less in the 7 days (63.4%). More than half (55.5%) of the respondents engage in screen-based activity, and 48.2% of them do so for ≤2 hours on an average day. The majority of the respondents (98.1%) had a moderate level of physical activity.

Table 3: Lifestyle choices of respondents

Variables	Frequency	Percentage
Snacking in the past week		
Yes	672	74.8
No	226	25.2
Frequency of snacking		
1-2 days/week	426	63.4
≥3 days/week	246	36.6
Screen-based activity		
Yes	498	55.5
No	400	45.5
Length of TV watching		
Non-sedentary	258	51.8
Sedentary	240	48.2
Skipping of meals		
Yes	385	42.9
No	513	51.3
Level of physical activity		
Low	10	1.1
Moderate	881	98.1
High	7	0.8

Table 4 shows the association between socio-demographic characteristics and overnutrition among adolescents in this study. Respondents' age, gender, father's occupation and mother's education were significantly associated with overnutrition.

Table 4: Association between sociodemographic characteristics and overnutrition among respondents

Variables	Overnutrition			
	Present	**Absent**	**χ2**	**p-value**
Age				
10-13	13(8.8)	130(17.3)	10.084	0.006*
14-16	79(53.7)	417(55.5)		
17-19	55(37.4)	204(27.2)		
Gender				
Male	53(36.1)	380(50.6)	10.416	0.001*
Female	94(63.9)	371(49.4)		
Religion				
Christianity	109(74.1)	529(70.4)	3.248	0.197
Islam	32(21.8)	205(27.3)		
Traditional	6(4.1)	17(2.3)		
Ethnicity				

Yoruba	137(93.2)	683(90.9)	1.932	0.587
Hausa	1(0.7)	8(1.1)		
Igbo	9(6.1)	52(6.9)		
Others	0(0.0)	8(1.1)		
Father's occupation				
Professional/Skilled	65(44.2)	366(48.7)	10.344	0.035*
Semi-skilled	20(13.6)	54(7.2)		
Unemployed	9(6.1)	24(3.2)		
Trading	52(35.4)	303(40.3)		
Unskilled	1(0.7)	4(0.5)		
Mother's occupation				
Professional/Skilled	40(27.2)	243(32.4)	7.676	0.104
Semi-skilled	13(8.8)	37(4.9)		
Unemployed	8(5.4)	41(5.5)		
Trading	85(57.8)	430(57.3)		
Unskilled	1(0.7)	0(0.0)		
Father's education				
No formal	6(4.1)	43(5.7)	1.441	0.696
Primary	10(6.8)	37(4.9)		
Secondary	75(51.0)	382(50.9)		
Tertiary	56(38.1)	289(38.5)		
Mother's education				
No formal	3(2.0)	42(5.6)	10.277	0.016*
Primary	11(7.5)	38(5.1)		
Secondary	92(62.6)	389(51.8)		
Tertiary	41(27.9)	282(37.5)		

Table 5 shows the association between lifestyle choices and overnutrition among respondents. It shows meal skipping and level of physical activity were significantly associated with overnutrition.

Table 5: Association between lifestyle choices and overnutrition among respondents

Variables	Overnutrition			
	Present	**Absent**	**Test statistics**	**p-value**
Snacking				
Yes	117(79.6)	555(73.9)	2.114	0.146
No	30(20.4)	196(26.1)		
Frequency of snacking				
1-2 days/week	71(60.7)	355(64.0)	0.448	0.503
≥3 days/week	46(39.3)	200(36.0)		
Screen-based activity				
Yes	84(57.1)	414(55.1)	0.202	0.653
No	63(42.9)	337(44.9)		
Television frequency				
Non-sedentary	45(53.6)	213(51.4)	0.126	0.723
Sedentary	39(46.4)	201(48.6)		
Skipping of meals				
Yes	77(52.4)	308(41.0)	6.488	0.011*
No	70(47.6)	443(59.0)		
Transportation mode				
Bicycle	18(12.2)	102(13.6)		
Motorcycle	44(29.9)	228(30.4)	7.676	0.104
Public transport	24(16.3)	137(18.2)		
Trekking	46(31.3)	213(28.4)		
Parent's car	15(10.2)	71(9.5)		
Level of physical activities				
Low	0(0.0)	10(1.3)	6.523	0.038*
Moderate	118(97.5)	763(98.2)		
High	3(2.5)	4(0.5)		

Table 6 shows predictors of overnutrition among adolescents in this study. The variables that were statistically significant with overnutrition at the bivariate level were entered into the binary logistic model. Age, gender, father's occupation, mother's education, and level of physical activity were the factors that remained statistically significant with overnutrition among adolescents in this study.

Table 6: Predictors of overnutrition among respondents.

Variables	AOR (95% CI)	p-value
Age		
10-13	0.448(0.217 – 0.925)	0.030*
14-16	0.686(0.452 – 1.041)	0.077
17-19	1	
Gender		
Male	0.467(0.311 – 0.703)	0.001*
Female	1	
Religion		
Christianity	0.663(0.219 – 2.006)	0.467
Islam	0.523(0.165 – 1.657)	0.270
Traditional	1	
Father's occupation		
Professional/Skilled	1.436(0.887 – 2.324)	0.141
Semi-Skilled	2.505(1.229 – 5.105)	0.011*
Unemployed	2.376(0.938 – 6.018)	0.068
Trading/Unskilled	1	
Mother's occupation		
Professional/Skilled	0.894(0.536 – 1.492)	0.669
Semi-Skilled	0.944(0.426 – 2.093)	0.887
Unemployed	0.883(0.370 – 2.108)	0.779
Trading/Unskilled	1	
Father's Education		
No formal education	0.547(0.172 – 1.739)	0.306
Primary Education	0.854(0.352 – 2.072)	0.727
Secondary Education	0.623(0.370 – 1.049)	0.075
Tertiary Education	1	
Mother's Education		
No formal education	0.672(0.149 – 3.032)	0.605
Primary Education	2.513(1.003 – 6.296)	0.049*
Secondary Education	2.167(1.252 – 3.751)	0.006
Tertiary Education	1	
Snacking in the past 7 days		
Yes	1.458(0.910 – 2.334)	0.117
No	1	
Screen-based activity		
Yes	0.996(0.679 – 1.461)	0.985
No	1	
Skipping meal		
Yes	1.467(0.999 – 2.154)	0.051
No	1	
Mode of Transport		
Bicycle	0.681(0.305 – 1.523)	0.349
Motorcycle	0.822(0.408 – 1.656)	0.583
Public transport	0.834(0.389 – 1.791)	0.642
Trekking	0.854(0.424 – 1.720)	0.658
Parent's car	1	
Physical activities		
Low	0.000(0.000 – 0.000)	0.998
Moderate	0.094(0.015 – 0.604)	0.013*
High	1	

Discussion

The prevalence of overnutrition (obesity and overweight) among adolescents in this study was high (16.4%), higher than what was reported in studies in Ile-Ife (12.8%), Oyo (12.9%), Benin (12.7%) and Abuja (15.4%), all in Nigeria (21, 23, 24, 25). The high prevalence, though alarming, might be explained by their increased access to unhealthy foods and snacks that are high in calories, fat and energy, and a decline in physical activity from overuse of electronic devices This high prevalence of overnutrition in rural areas is a rather surprising finding, but can be explained by the fact that people living in the rural areas attach being obese and overweight to high socio-economic class.

The snacking habits of adolescents in this study were observed to be high (74.8%). This was similar to what was observed in a study conducted in Edo Nigeria (26), but considerably higher than what was reported in a related study conducted in Malaysia which found 40.6% of adolescents consumed fast foods regularly (27). The high prevalence of snacking in this study could be because of the convenience attached to eating especially when they have to spend long hours away from home. On a school day, most adolescents spend as much as 9 hours in school for academic and extracurricular purposes. It could also be due to the rave of imbibing the dietary habits of the Western world and the promotion of combination meals of Sugar-sweetened beverages with fast foods at various outlets.

Skipping of meals was significantly higher in this study. This is similar to findings from a nutritional study in Abuja Nigeria which reported that adolescents in rural areas skip meals more than those in the urban (25), but in contrast with another adolescent study on food consumption patterns of adolescents and their effect on their body weight which reported that adolescents living in urban areas skip meals more than their rural counterparts (28). In addition, the screen-based activity of adolescents in this study was high; adolescents now have access to an array of video games, and reality shows on television.

The risk of being overweight and obese in adolescence begins with what a child is fed on during childhood which reported that adolescents living in urban areas skip meals more than their rural counterparts (5). Children and adolescents' food choices are one of the determinants of their nutritional status which reported that adolescents living in urban areas skip meals more than their rural counterparts (29). This statement supports the findings of a study conducted in Botswana reported that as of the year 2000, approximately 10% of youth aged 5-17 years were overweight and 2-3% were obese due to their food consumption patterns which were characterised by snacks and sugary beverages which reported that adolescents living in urban areas skip meals more than their rural counterparts (29). Another study identified snacking and fast-food consumption as a contributory factor to the development of overweight and obesity in Nigerian adolescents which reported that adolescents living in urban areas skip meals more than their rural counterparts (28). In addition, a study conducted in the United Kingdom, on fast food and obesity in the adolescent population, also found a positive association between fast food or take-away food consumption and increased BMI which reported that adolescents living in urban areas skip meals more than their rural counterparts (30). Although the majority of adolescents (74.8%) snacked in this study, snacking was not significantly associated with overnutrition.

The father's occupation was identified as a predictor of overnutrition in this study. This finding was similar to findings from a study which found that the socioeconomic status (SES) of adolescents' parents is a predictive factor for overweight and obesity in adolescents which reported that adolescents living in urban areas skip meals more than their rural counterparts (31). African countries in the last few decades have experienced rapid growth and development in both social and economic sectors that resulted in improved lifestyles of the populace which reported that adolescents living in urban areas skip meals more than their rural counterparts (29). This rapid economic development manifested in the accumulation of different assets which further widened the socioeconomic strata among the people and equally changed the cause of death from infectious to chronic NCDs which reported that adolescents living in urban areas skip meals more than their rural counterparts (29). Higher SES could be found among students whose parents have a higher earning power, and the level of assets acquired by the student's parents could also indicate higher SES. Some studies have assessed the association between the SES of adolescents and the emerging overweight and obesity epidemic among adolescents in rural areas and public secondary schools, especially in Nigeria. The presence of certain facilities at home such as television, computer, refrigerator, and other electronic gadgets has been associated with adolescents who are overweight and obesity could serve as a useful strategy to determine the adolescents' level of SES in lower SES which reported that adolescents living in urban areas skip meals more than their rural counterparts (31, 32).

This study, like several others, reported physical activities as a predictor of overnutrition among adolescents and concluded that adolescents who had low physical activity levels are more predisposed to being overweight or obese which reported that adolescents living in urban areas skip meals more than their rural counterparts (33). This is in contrast to another Nigerian study that did not find an association between physical activity levels and overnutrition which reported that adolescents living in urban areas skip meals more than their rural counterparts (34). This disparity in findings could be due to the age and sex distribution of adolescents in both studies. Physical inactivity is the fourth leading factor of global mortality and increasing physical inactivity has been seen worldwide with 1 in 3 adults not being so active which reported that adolescents living in urban areas skip meals more than their rural counterparts (35).

Conclusion
Adolescence is a vulnerable period in the development of major NCDs. Lifestyle changes during this period, such as a newly discovered autonomy and peer pressure may result in adopting long-lasting unhealthy behaviours that could lead to overweight and obesity. Given the global extent of the obesity epidemic and the exorbitant costs of treatment of its complications, instituting comprehensive health intervention programs should be a public health priority in preventing the estimated 1.4 million nutritional-related deaths that occur globally every year in the adolescent population. The high prevalence of overnutrition, is a matter of great concern for policymakers to instate obesity control policies, especially in this group of people.

List of Abbreviations
BMI: Body mass index
LGA: Local Government Area
NCD: Non-Communicable Diseases.
NFSI: Nutrition-Friendly Schools Initiative

FAO: Food and Agricultural Organization
PAQ-A: Physical Activity Questionnaire for Adolescents
SES: Socioeconomic status
SSB: Sugar-sweetened beverages
WC: Waist circumference
WHO: World Health Organisation

Declarations
Ethical approval and consent to participate
The ethical approval for this study was obtained from the Ogun State Ministry of Health, Department of Health Planning, Research and Statistics. The ethical approval reference number is HPRS/381/340. Approval to conduct the study was obtained from the Ogun State Ministry of Education, Science and Technology, while permission was sought from the Zonal Education Officers of the selected LGAs; and the principals of the selected schools. Written informed consent was obtained from adolescents aged 18 years and above. For adolescents younger than 18 years of age, informed consent was obtained from their parents, and assent was obtained from the prospective participants. Participation in this study was voluntary, and participants were free to withdraw at any stage in the course of the study with no consequences following their actions. Participants were assured of strict confidentiality of all information collected from them. Other principles of the Helsinki Declaration were observed.

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