[Downloaded free from http://www.njcponline.com on Thursday, September 14, 2017, IP: 165.255.145.160]

Original Article

Comparison of Obesity, Overweight and Elevated Blood Pressure in Children Attending Public and Private Primary Schools in Benin City, Nigeria

WE Sadoh, YT Israel-Aina, AE Sadoh, JE Uduebor[1], M Shaibu[2], E Ogonor, FC Enugwuna[3]

Department of Child Health, University of Benin Teaching Hospital, PMB 1111, Benin City, Edo State, [1]Department of Paediatrics, Delta State University Teaching Hospital, Oghara, Delta State, [2]Department of Child Health, Kuje General Hospital, FCTA Abuja, [3]Ibrahim Babangida Government Specialist Hospital, Minna, Nigeria

Abstract

Background: Overweight and obesity in children, and adolescents is on the rise globally. Affected children are prone to cardio-metabolic problems later in life, especially hypertension. The prevalence of obesity/overweight may differ depending on school type. Private schools are attended mostly by children of the affluent, while public schools are attended predominantly by those in the low and middle socio-economic classes. **Objective:** To compare the prevalence of overweight, obesity and elevated blood pressure (BP) in pupils attending public and private primary schools in an urban community in Nigeria. **Materials and Methods:** In this cross sectional study, the BMI and BP of pupils in public and private primary schools, recruited by multistage sampling method, were measured. Their nutritional status was categorized using their BMI percentiles. Analysis was by SPSS. **Results:** A total of 1466 pupils were recruited, 814(55.5%) were in public schools and 722(49.2%) were males. The prevalence of overweight and obesity was higher in private schools 11.8% and 11.7% compared to public schools 3.3% and 0.9%. The mean systolic BP of pupils in public schools 96.8 ± 12.5 mmHg was higher than that in private schools 95.5 ± 10.2 mmHg, p = 0.032. Distribution of pupils with prehypertension and hypertension between private and public schools was not significantly different. **Conclusion:** The prevalence of overweight and obesity is higher in pupils attending private schools compared to those in public school. Urgent measures are needed to stem this tide through education, weight reduction and physical activity programs, especially in pupils attending private schools.

Date of Acceptance:
15-Dec-2016

Keywords: *Blood pressure, body mass index, obesity, overweight, private schools*

Introduction

The prevalence of overweight and obesity is on the rise, with a global increase of 47.1% for children between 1980 and 2013.[1] The prevalence of overweight and obesity in previous Nigerian studies range from 5.8%-13.8% and 0.3%-9.4 % respectively for overweight and obesity.[1-5] Higher values were obtained in children from big cities and would seem to be close to the ones obtained in some developed countries.[1,6] The change in life style in most urban settings in Nigeria in addition to the reduction in physical activity, as people move from one place to another by means of transportation rather than walking, and the overindulgence in sedentary activities such as television watching. Westernization of the populace that involves change in diet, indulgence in refined western kind of food, eating out in high calorie fast food restaurants, which are common place now in most Nigerian cities.[7] The combination of consumption of high calorie foods and declining levels of physical activity in our children is perhaps a major contributor in the rise of overweight and obesity. A study conducted by Omuemu *et al.*[7] in Benin City, showed that a high proportion of adolescent school going children indulge in fast food and soda drinks regularly. Those with a higher purchasing power are more likely to indulge in these habits.

In developing countries where malnutrition was a major and predominant nutritional problem,[8] overweight and obesity is also emerging as a significant nutritional issue leading to the double burden of nutritional diseases (referring to both malnutrition and over nutrition).

Address for correspondence: WE Sadoh,
Department of Child Health, University of Benin Teaching Hospital, Benin City, Edo State, Nigeria.
E-mail: sadohehi@yahoo.com

Access this article online

Quick Response Code:

Website: www.njcponline.com

DOI: 10.4103/1119-3077.212445

This is an open access article distributed under the terms of the Creative Commons Attribution-Non Commercial-Share Alike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: Sadoh WE, Israel-Aina YT, Sadoh AE, Uduebor JE, Shaibu M, Ogonor E, *et al.* Comparison of obesity, overweight and elevated blood pressure in children attending public and private primary schools in Benin City, Nigeria. Niger J Clin Pract 2017;20:839-46.

[Downloaded free from http://www.njcponline.com on Thursday, September 14, 2017, IP: 165.255.145.160]

Underlying malnutrition is associated with other childhood illnesses such as pneumonia, tuberculosis, diarrhea and severe malaria which are major contributors to childhood mortality.[9] Overweight and obesity, on the other hand, is said to be predisposed to cardio-metabolic problems of stroke, myocardial infarction, dyslipidemia, diabetes mellitus and hypertension later in life.[10,11] Obese children also suffer emotional assault from peers, as they are often the subjects of ridicule in school and in the community.[12]

Obesity is a major contribution to Hypertension.[13] The positive correlation between overweight, obesity and elevated blood pressure has been reported in a number of studies.[2-5] Life style modifications including weight reduction and regular physical activity have been known to halt and reverse this trend.[13] School children attending highbrow private schools who are mostly from high socioeconomic class (SEC), are perceived to be more likely to engage in a sedentary lifestyle, indulgence in consumption of fast food and thus, more likely to be overweight/ obese compared to their counterparts in public schools, most of whom are perceived to be from low to middle SEC and are physically more active.

The objectives of this study were (1) to compare the prevalence of overweight, obesity and elevated blood pressure in pupils attending public and private primary school and (2) to evaluate the relationship between their weight and blood pressure.

Materials and Methods

Study design

This cross sectional study was conducted in Egor Local Government Area (LGA), of Edo State of Nigeria, as part of a larger study, to evaluate cardiovascular risks in children. LGA is the unit administered by the third of the three tiers of government in Nigeria; the other tiers being the State and Federal governments.

Setting

Egor LGA has an estimated total population of 339,899 of which 119,038 are aged less than 15 years.[14] It has ten political wards of which eight are urban. This study was conducted over a six month period (September 2011 to February 2012). Ethical approval for this study was obtained from the Ethics Committee of a tertiary hospital in the state.

Sample size

A convenience sample size of 1760 primary school children of the original study on cardiovascular risk was studied. Only children with complete data on BP, weight, height and socio-economic class were recruited for this study.

Inclusion criteria: All male and female primary school pupils aged between 5 and 15 years, whose parents gave consent were recruited.

Exclusion criteria: School children whose parents declined the study and children with obvious clinical features of chronic illnesses such as sickle cell anemia, renal abnormalities, etc.

Sampling technique

The pupils were selected using a multistage sampling technique. Of the 10 political wards, 30% (3) were randomly selected from a list of the political wards as the first stage sampling process. There were 8 public and 19 private schools listed alphabetically from which 30% each of private and public schools were selected. . Thus, 3 public and 6 private schools were selected using a systematic sampling technique after randomly selecting the first school (second stage). The details of the sampling procedure are described in a previous publication.[15]

Private schools are usually expensive, of a high academic standard and attended mostly by children of the elite while public schools are government owned, attended predominantly by children of low and middle social strata; and usually affordable with an acceptable standard of education.

Evaluation of selected pupils

An informed written consent was obtained from the parents of each selected pupil. Any child, whose parent declined to give consent was replaced by the next pupil on the sampling list, selected using the sampling interval and whose parents gave consent. A socio-economic class (SEC) was ascribed to each selected pupil using the method described by Olusanya *et al.*[16] This method was based on the level of education of the mother and the father's occupation.

Measurement of anthropometry and Blood Pressure

The weight was measured with the Omron body composition monitor (BF511Netherlands) using standard methods. Weight was read to the nearest 0.1 kg. Height was measured with the aid of a stadiometer. The pupils were instructed to stand bare feet, with their heels, buttocks and occiput resting against the stadiometer. The chin was raised so that the pupil was looking ahead with the upper border of the ear canal in the same horizontal plane as the lower border of their eye socket (Frankfurt plane).[17] Height was read to the nearest 0.1 cm. BMI according to age was then computed for the pupils as the ratio of the weight in kg/ square of the height in meters (m2). The pupils were categorized by gender and age using the United States Center for Disease Control (CDC) BMI growth charts were divided into obese: ≥

[Downloaded free from http://www.njcponline.com on Thursday, September 14, 2017, IP: 165.255.145.160]

95th percentile; overweight: 85th to < 95th percentile; healthy weight: 5th to < 85th percentile and underweight: < 5th percentile.[18]

BP was measured from the right upper arm. The pupils were made to sit down and relax for about 3 minutes, before the BP was measured. An appropriate sized cuff, with bladder width of about 40-50% of the arm circumference, and the bladder length of at least 80% of the arm circumference was used. The cuff was snugly wrapped around the right upper arm, and inflated to about 10 mmHg above the systolic BP determined by palpation. The bell of the stethoscope was then applied over the brachial artery and the cuff was slowly deflated at a rate of 2mm per second. The first Korotkoff sound was taken as the systolic BP while the fifth Korotkoff sound represented the diastolic BP. Two BP readings were taken three minutes apart and the average was taken as the patient's BP.[19] Hypertension and pre-hypertension were defined as elevated SBP or DBP ≥ 95th percentile and SBP or DBP between the 90th and < 95th percentile for the age, sex and height respectively according to the recommendation of National Blood Pressure Education Program.[19]

Children with obesity and overweight as well as their parents were counseled to engage their children in regular physical exercises and stay on appropriate diet. The children with hypertension were referred to the pediatric cardiology clinic for treatment and follow up.

Statistical analysis

The data was entered into SPSS version 16 (Chicago IL) spread sheet and analyzed with the same tool. Differences in means of continuous variables such as systolic and diastolic blood pressures were compared using student's t test, while One-Way Analysis of Variance was used to test the differences between more than 2 means. Differences across medians of BMI percentiles of different categories of pupils were compared with Krukas-Wallis Test. The differences in proportions were tested using $\chi 2$ test. Bivariate analysis of the effect of age, weight and height on mean systolic BP (MSBP) and mean diastolic BP (MDBP) were tested with Spearman's linear regression while multiple linear regression models were used to determine independent predictors of the MSBP and MDBP. Level of significance was set at P = < 0.05 at 95% of confidence level.

Results

From a total of 1764 school children recruited in the original study, 1466(83.3%) pupils who had complete data on BP, weight, height and socioeconomic class were recruited for the present study. Of the remaining 298 pupils who were not studied, 243(%) did not have BP measurement, while the remaining 55 did not have weight, height or socio-economic status.

The 1466 pupils recruited for this study, consisted of 814(55.5%) from public schools and 652(44.5%) from private schools. The mean age of the pupils was (9.0 ± 2.2; range: 5-15) years. The mean age of pupils in public schools, 9.7 ± 2.2 years was significantly higher than that of the pupils in private schools 8.0 ± 1.8 years, p = <0.0001.

There were 722(49.2%) male and 744(50.8%) females. There was no significant difference between the mean age of male pupils 9.1 ± 2.2 years and the female pupils 8.9 ± 2.2 years, p = 0.082. Majority of the pupils 723(49.3%) were from low SEC background. The socio-demographic distribution of the pupils by school type is depicted in Table 1.

Nutritional status and Anthropometry

Of the 1466 pupils studied, 1167(79.6%) had healthy weight, while 112(7.6%) were underweight. A total of 104 and 83 pupils were overweight and obese, giving a prevalence of 7.1% and 5.7% of overweight and obesity respectively. The prevalence of overweight and obesity in the public schools were (27/814) 3.3% and (7/814) 0.9% respectively while in the private schools; the prevalence of overweight and obesity were (77/652) 11.8% and (76/652) 11.7% respectively. The distribution of the nutritional status according to school type is shown in Table 2.

Table 1: Socio-demographic characteristics of the study population

Characteristics	Public School n(%)	Private School n(%)	Total	P value
Gender				
Male	414(57.3)	400(53.8)	814	0.19
Female	308(42.7)	344(46.2)	652	
Socio-economic classss				
High	15(1.8)	449(68.9)	464	<0.0001
Middle	152(18.7)	127(19.5)	279	
Low	647(79.5)	76(11.6)	723	

[Downloaded free from http://www.njcponline.com on Thursday, September 14, 2017, IP: 165.255.145.160]

The median BMI percentile of the 1466 pupils studied was 40.5(0.1-99.9). The median BMI percentile and range of the study population according to school type and gender is shown in Table 2. The mean weight of pupils from private schools was significantly higher than that of pupils from public schools, $p = 0.0042$. There were significantly more overweight and obese pupils from private schools compared to their counterparts from public schools, $p = <0.0001$ [Table 2]. The pupils from private schools also had a significantly higher median BMI percentile compared to those from public schools, $p < 0.0001$ [Table 2].

Table 2 shows that among pupils in public schools, those from low SEC had a higher median BMI percentile compared to pupils from middle and high SEC, the difference was however not statistically significant, $p = 0.74$. While among the pupils in private schools, those

Table 2: Comparison of some socio-demographic and anthropometric parameters between private and public schools

Characteristics	Public School	Private School	Total	P value
Mean weight(kg)	28.3 ± 7.4	29.5 ± 8.6		0.0042
Mean Height(cm)	130.6 ± 10.5	130.8 ± 9.8		0.71
Gender(Median BMI percentiles)				
Male	34.5(0.1-96.4)	50.6(0.2-99.9)		<0.0001
Female	35.6(0.1-97.9)	51.5(0.1-99.8)		<0.0001
Socioeconomic class(Median BMI percentiles)				
High	25.5(0.2-71.6)	52.8(0.1-99.8)		0.042
Middle	31.6(0.5-91.8)	48.8(0.1-99.9)		<0.0001
Low	35.2(0.1-97.9)	41.9(0.4-93.1)		0.35
Nutritional status [n(%)]				
Underweight	72(64.3%)	40(35.7%)	112	<0.0001
Healthy weight	708(60.7%)	459(39.3%)	1167	
Overweight	27(26.0%)	77(74.0%)	104	
Obesity	7(8.4%)	76(91.6%)	83	

Table 3: Comparison of mean systolic and diastolic blood pressures of public and private pupils

Characteristics	Public schools Mean (SD)	Private schools Mean (SD)	P value
Male SBP	96.0 ± 12.8	95.2 ± 9.6	0.31
Female SBP	97.6 ± 12.3	95.7 ± 10.8	0.036
Male DBP	61.1 ± 9.7	60.7 ± 8.1	0.52
Female DBP	62.6 ± 9.8	60.0 ± 7.1	0.0001
High SEC SBP	94.3 ± 11.1	95.5 ± 10.3	0.66
Middle SEC SBP	96.1 ± 12.5	95.7 ± 10.4	0.77
Low SEC SBP	97.0 ± 12.6	94.7 ± 9.7	0.12
High SEC DBP	59.4 ± 9.7	60.9 ± 8.5	0.50
Middle SEC DBP	61.3 ± 10.3	60.0 ± 7.1	0.23
Low SEC DBP	62.0 ± 9.6	58.7 ± 8.6	<0.0001
Underweight SBP	93.3 ± 12.9	90.5 ± 8.7	0.22
Healthy weight SBP	96.8 ± 12.4	93.0 ± 9.5	<0.0001
Overweight SBP	103.5 ± 11.5	100.0 ± 10.0	0.14
Obesity SBP	103.5 ± 12.9	102.8 ± 10.4	0.87
Underweight DBP	60.1 ± 11.0	56.4 ± 7.7	0.062
Healthy weight DBP	61.8 ± 9.6	59.7 ± 8.1	0.0001
Overweight DBP	65.8 ± 9.9	63.0 ± 7.9	0.14
Obesity DBP	66.7 ± 11.7	64.5 ± 7.6	0.49

[Downloaded free from http://www.njcponline.com on Thursday, September 14, 2017, IP: 165.255.145.160]

from high SEC had a statistically, significantly higher median BMI percentile compared to those from middle and low SECs, $p = 0.013$.

The mean weight of the males 28.6 ± 7.2 kg was not statistically, significantly different from the 29.1 ± 8.6kg recorded in the females, $p = 0.23$ while the mean height of the males 130.6 ± 9.8cm was also similar to that of females 130.7 ± 10.6cm, $p = 0.85$

Blood Pressure

The mean SBP and DBP of the pupils were 96.2 ± 11.6 mmHg and 61.2 ± 9.1 mmHg respectively. The mean SBP and DBP of the pupils according to school type are shown in Table 3. There was no significant gender difference in the mean SBP of the pupils studied, 95.7 ± 11.5mmHg and 96.7 ± 11.6 mmHg for males and females pupils respectively, $p = 0.1$. The mean SBP of the pupils in public schools 96.8 ± 12.5 mmHg was significantly higher than that of those in private schools 95.5 ± 10.2 mmHg, $p = 0.032$. The mean gender, SEC and nutritional classes' SBP and DBP according to school type is shown in Table 3.

Majority of the 1466 pupils, 1381(94.2%) had normal BP, while 45(3.1%) and 40(2.7%) respectively had BP in the pre-hypertension and hypertension range Table 4 shows the distribution of pupils with normal BP, pre-hypertension and hypertension by school type, gender, SEC and nutritional statuses. The proportion of obese

Table 4: The distribution of blood pressure status by school type, gender, socioeconomic class and nutritional statuses

Characteristics	Normal BP n(%)	HTN n(%)	Pre-HTN n(%)	Total	P value
School type					
Public	767(55.5)	22(55.0)	25(55.6)	814	0.99
Private	614(44.5)	18(45.0)	20(44.4)	652	
Gender					
Male	693(50.2)	13(32.5)	16(35.6)	722	0.015
Female	688(49.8)	27(67.5)	29(64.4)	744	
Socio-economic class					
High	439(31.8)	11(27.5)	14(31.1)	464	0.74
Middle	259(18.8)	11(27.5)	9(20.0)	279	
Low	683(49.4)	18(45.0)	22(48.9)	723	
Nutritional status					
Underweight	109(7.9)	1(2.5)	2(4.5)	112	0.014
Health weight	1106(80.1)	29(72.5)	32(71.1)	1167	
Overweight	95(6.9)	4(10.0)	5(11.1)	104	
Obesity	71(5.1)	6(15.0)	6(13.3)	83	

BP = blood pressure, HTN = Hypertension, Pre-HTN = Pre-hypertension

Table 5: Correlation of mean SBP and DBP with age, weight and height in bivariate analysis

Variables	R values	P values
MSBP vs Age	0.33	0.0001
MSBP vs BMI	0.32	0.0001
MSBP vs Height	0.38	0.0001
MSBP vs Weight	0.43	0.0001
MDBP vs Age	0.28	0.0001
MDBP vs BMI	0.25	0.0001
MDBP vs Height	0.38	0.0001
MDBP vs Weight	0.35	0.0001

Table 6: Multiple linear regression models of independent predictors of mean SBP and DBP

Variables	SBP			DBP		
	Beta	t	P value	Beta	t	P value
Constant		15.30	0.0001		11.05	0.0001
Age	0.10	3.31	0.001	0.091	2.79	0.005
Height	0.06	1.52	0.13	0.076	1.86	0.063
Weight	0.33	8.79	0.0001	0.24	6.27	0.0001

R^2 = 19.7% and 13.3% respectively for the models for Mean SBP and Mean DBP

[Downloaded free from http://www.njcponline.com on Thursday, September 14, 2017, IP: 165.255.145.160]

pupils with BP in the pre-hypertension and hypertension range was significantly higher than in those who were overweight, underweight or had healthy weight, p = 0.014. Similarly, the female pupils had a significantly higher proportion of those with pre-hypertension and hypertension compared to their male counterparts.

Relationship of SBP and DBP with some variables

The mean SBP and mean DBP were significantly, positively correlated with the age, weight and height in bivariate analysis, only age and weight remained as independent predictors of MSBP and MDBP in multivariate analysis. [Table 5] and [Table 6]. The R2 and p values for the MSBP and MDBP models were respectively 19.7% and 13.3%; p = 0.0001 and 0.0001.

Discussion

In this study, the prevalence of overweight and obesity of 7.1% and 5.7% respectively in the general study population is within the range documented in some previous studies in Nigeria.[2-4,7] However, the prevalence of overweight and obesity of 11.8% and 11.7% respectively in private school pupils were quite high in comparison to the figure obtained by Oduwole *et al.* [20] from a single school in Lagos Nigeria and other western countries.[1] The higher prevalence obtained in private schools compared to public schools may stem from the fact that significantly more pupils from high SEC attend private schools instead of public ones. Pupils from high SEC are more likely to eat high calorie food and drinks because of the higher economic power of their parents. Change in diet towards more western food which is high in calorie content, has been identified as a major contributor to overweight and obesity in developing countries.[21] In addition, the children from high SEC are more likely to be driven to school, spend more time watching TV and playing video games. This is compounded by the poor security situation in the country that has led to these children being restricted to their fenced compounds with little space for recreation and other physical activities. This sedentary lifestyle promotes a tendency towards being overweight and obese.

Another reason for the higher prevalence of overweight and obesity in pupils attending private schools may be the perception that bigger children are healthier than thinner ones as their big size may indicate that they are better cared for by their affluent parents. The big size is, thus, a ‘status symbol’ for these children. The cultural perception and acceptability of fatter people as being better than thinner ones has been reported amongst Gambian people.[22]

The pupils from private schools were significantly younger than those from public school, despite which pupils attending private schools were significantly heavier than their counterparts in public schools. This non-age related reason for pupils in private schools being heavier than those from public schools is perhaps another indicator that other factors such as higher calorie intake and low physical activities maybe contributory here, even though they were not specifically evaluated in this study.

The mean systolic BP of pupils from public schools was significantly higher than that from private schools despite the fact that pupils from public schools were significantly lighter and thus, expected to have a lower BP. The higher SBP in pupils from public schools could be ascribed to the older mean age of pupils attending public school. Blood pressure increases with age. It is also possible that the different environmental stressors occasioned by their socioeconomic settings may have contributed to this finding.[23]

The prevalence of pre-hypertension and hypertension of 3.1% and 2.7% is higher than previous Nigerian study in Enugu [24] that reported a value 1.9%. The value in the Enugu study was easy to compare with the current study because of the similarity in definition of elevated BP. The higher prevalence of elevated BP in the current study may be associated with the higher prevalence of overweight and obesity in this study compared to the Enugu study where values of 6.4% and 1.7% were reported for overweight and obesity respectively. It is curious that despite the significant weight and BMI differences between public and private school pupils, the difference in prevalence of pre-hypertension and hypertension between the school types was not significant. The reason for this finding is not apparent. It, however, suggests that weight may not be the only major contributor to elevated BP is this study.

The female pupils had significantly higher proportion of pupils with pre-hypertension and hypertension compared to their male counterparts. This has similarly been reported by other workers [20,25] The reason for the difference in this study is not apparent, as the gender weight and BMI differences in the study population was not statistically significant. Most previous studies on BP in children, that noted a higher BP in females compared to males, had also documented a correspondingly higher body mass in the females compared to the males.[20,25] Similarly, the mean SBP and DBP of female pupils in public schools were higher than those in private schools despite the fact that female pupils in public schools were significantly lighter. This again points towards the influence of other factors besides body weight on BP in these children.

[Downloaded free from http://www.njcponline.com on Thursday, September 14, 2017, IP: 165.255.145.160]

Expectedly the prevalence of pre-hypertension and hypertension was significantly higher in obese pupils compared to those who are overweight, underweight or had healthy weight. This finding, however, underscores the influence of body mass on BP and the effect of obesity on cardiovascular health. These finding may be indicators of the likely high burden of cardiovascular and other metabolic morbidities such as hypertension and obesity that may confront the nation's health sector in the future. Considering the already high burden of these morbidities currently in the country,[26] the health sector is likely to be overstretched in terms of patient load and healthcare cost.

The effect of body mass on BP was further exemplified by the positive correlation of weight, height and age on SBP and DBP in the bivariate analysis. The mean SBP and DBP rose with increasing age, and body mass. The height was not a significant predictor of MSBP or MDBP in the multivariate analysis. This finding has been similarly reported in previous studies and speaks to the lower influence height has on BP compared to weight and age.[27]

The higher prevalence of overweight and obesity in pupils from private schools may represent a stage of nutritional transition where the affluent and their children because of their higher economic power, are the ones suffering from overweight and obesity. It is imperative that Nigeria joins the global efforts to begin to address the problem through establishment of programs aimed at educating the children and their parents about the dangers of overweight and obesity and engagement in physical activity programs targeted at not only the children of the elite but everybody. The tendency for bigger children may 'spill over' to the parents from the low socio-economic strata. The resulting explosion of overweight, obesity may thus increase the burden and could be more difficult to tackle. There is a report already showing a higher prevalence of overweight and obesity amongst adolescents in rural (with predominantly low to middle income people) compared to urban (largely middle to high income families) setting in Ondo, Nigeria.[28] Although the prevalence in the study were low, the reasons for the higher prevalence of overweight and obesity in the rural setting may not be unconnected with the change to sedentary lifestyle and high calorie diet among the rural adolescents.

The prevalence of underweight was comparable to that of overweight and obesity in the current study and points to the double burden of malnutrition in the country. It also draws attention to the fact that as much as we begin to address overweight and obesity in our children, there is the need to also intensify efforts to further reduce malnutrition.

The limitation in this study is that BP measurement was not repeated in pupils who had elevated BP. It is recommended that the BP of individuals with elevated levels be measured twice, before declaring such BP as hypertension only if they are consistently elevated.[19] The pupils in this study with BPs in the hypertensive range may only be said to have elevated BP.

In conclusion, the prevalence of overweight and obesity in pupils attending private school was significantly higher than those in public schools. The pupils in private school had significantly lower SBP compared to those in public schools despite their significant higher body mass. The prevalence of pre-hypertension and hypertension was significantly higher in obese children compared to those in overweight, underweight and healthy weight categories. Urgent intervention programs that include, educating the school authorities, especially the private ones about over nutrition, and steps such as changing unfavorable eating pattern, engagement in physical activities are needed. There is need to legislate for the provision of adequate recreational and physical activity facilities in schools and the community.

Financial Support and Sponsorship

Nil

Conflicts of interest

There are no conflicts of interest

Reference

1. Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margorro C, *et al.* Global, regional and national prevalence of overweight and obesity in children and adults during 1980-2013: A systematic analysis for the global burden of diseases study 2013. Lancet 2014;384:766-81.
2. Ansa VO, Odigwe CO, Anah MU. Profile of body mass index and obesity in Nigerian children and adolescents. Niger J Med 2001;10:78-80.
3. Senbanjo IO, Adejuyigbe EA. Prevalence of overweight and obesity in Nigerian preschool children. Nutr Health 2007;18:391-9.
4. Chinedu SN, Eboji OK, Emiloju OC. Trends in weight abnormality of school children and adolescents in Nigeria. J Med Sci 2012;12:239-43.
5. Chukwumah NM, Azodo HA, Enabulele JE. Relating dental caries experience with body mass index among Nigerian primary school children: A cross-sectional survey. J Educ Ethics Dent 2012;2:28-32.
6. US preventive Services Task force: Screening for obesity in children and adolescents. US Preventive Services Task Force recommendation statement. Pediatrics 2010;125:361-7.
7. Omuemu VO, Omuemu CE. The prevalence of overweight and its risk factors among adolescents in an urban city in Edo State. Niger J Clin Pract 2013;13:128-33.
8. van der Sande MA, Milligan PJ, Nyan OA. Obesity and undernutrition and cardiovascular risk factors in rural and urban Gambian communities. Am J Public Health 2001;91:1641-4.

[Downloaded free from http://www.njcponline.com on Thursday, September 14, 2017, IP: 165.255.145.160]

9. Pelletier DL, Jr Frongillo EA, Schroeder DG, Habicht JP. The effects of malnutrition on child mortality in developing countries. Bull World Health Organ 1995;73:243-8.
10. Novac O, Matasaru S, Tataru S, Felea D, Cosmescu A, Chiosac AA. The assessment of weight excess complications for children and school teenagers. Rev Med Chir Soc Med Nat lasi 2009;113:740-4.
11. Skelton JA, Rudolph CD. Overweight and obesity. In: Kliegman RM, Behrman RE, Jenson HB, editors. *Nelson Textbook of Paediatrics*. 18th ed, Edited by Kliegman RM, Behrman RE, Jenson HB. Philadelphia: WB Saunders Co; 2007.pp 966-72
12. Brownwell KD, Wadden TA. Confronting obesity in children: Behavioural and psychological factors. Pediatr Ann 1984;13:473-80.
13. Gundogzu C. Relationship between BMI and blood pressure in boys and girls. Public Health Nutr 2008;11:1085-8.
14. Federal Republic of Nigeria 2006 population and housing census of Nigeria. Lagos: Federal Republic of Nigeria official gazette. 2007;94.
15. Sadoh WE, Omuemu VO, Israel-Aina YT. Prevalence of rheumatic heart disease among primary school pupils in mid-Western Nigeria. East Afr Med J 2013;90:21-5.
16. Olusanya O, Okpere E, Ezimokhai M. The importance of socio-economic class in voluntary infertility control in a developing country. West Afr J Med 1985;4:205-21.
17. Marfen-Jones N. International society for the advancement of Kinanthropometry. International standards for anthropometric assessment. Potchefstroom (South Africa) 2006.
18. Ogden CL, Kuczmarski RJ, Flegal KM, Mei Z, Guo S, Wel R, *et al.* Centers for Disease Control and Prevention 2000 growth charts for the United States: Improvements to the National Centre for Health Statistics version. Pediatrics 2000;109:45-60.
19. National High Blood Pressure Education Program Working Group on high blood pressure in children and adolescents. Fourth report on the diagnosis, evaluation and treatment of high blood pressure in children and adolescents. Paediatrics 2004;114:555-66.
20. Oduwole AA, Ladapo TA, Fajolu IB, Ekure EN, Adeniyi OF. Obesity and elevated blood pressure among adolescents in Lagos, Nigeria: A cross sectional study. BMC Public Health 2012;12:616.
21. Popkin BM. Global changes in diet and activity patterns as drivers of the nutrition transition. In: Kalhan S, Pentice AM, Yajnik C, editors. Emerging societies-coexistence of childhood malnutrition and obesity. Nestle Nutr Workshop Ser Pediatr Program. Vevey, Nestec/Basel, Krager, 2008; 63:1-14
22. Siervo M, Grey P, Nyan OA, Prentice AM. A pilot study on body image, attractiveness and body size in Gambians living in an urban community. Eat Weight Disord 2006;11:100-9.
23. Hamidu LI, Okoro EO, Ali MA. Blood pressure profile in Nigerian children. East Afri Med J 2000;77:180-4.
24. Odetunde OI, Neboh EE, Chinawa JM, Okafor HU, Odetunde OA, Ezenesu OU, *et al.* Elevated arterial blood pressure and body mass index among Nigerian pre-school children population. BMC Pediatr 2014;14:64-doi:10.1186/1471-2431-14-64.
25. Ansa VO, Anah MU, Ody FA, Mbu PN, Agbor EI. Relationship between parental socioeconomic status and casual blood pressure in coastal Nigerian adolescents. West Afr J Med 2010;29:149-52.
26. Isezuo SA, Sabir AA, Ohwovorilole AE, Fasanmade OA. Prevalence, associated factors and relationship between prehypertension and hypertension: A study of two ethnic African populations in Northern Nigeria. J Hum Hypertens 2011;25:224-30.
27. Menard SW, Park MK, Yuan CH. The San Antonio biethnic blood pressure study: Auscultatory findings. J Pediatr Health Care 1999;13:237-44.
28. Mustapha RA, Sanusi RA. Overweight and obesity among in-school adolescents in Ondo State, Southwest Nigeria. Afr J Biomed Res 2013;16:205-10.