COMPARISON OF THE PREVALENCE OF OBESITY AND ASSOCIATED FACTORS IN PRIVATE AND PUBLIC PRIMARY SCHOOLS IN PORT HARCOURT, NIGERIA

BADEMOSI A.[1], BABATUNDE O.[2]

[1]*Department of Community Medicine, College of Medical Sciences, Rivers State University*

[2]*Centre for Health and Development, University of Port Harcourt*

Correspondence:

Email: bademosi.adetomi@yahoo.co.uk

ABSTRACT

Introduction:

Obesity among children is a growing health concern in the world and Nigeria. The increasing prevalence of childhood obesity has been associated with increased child mortality rates. A variety of factors have been associated with the increasing trend of childhood obesity globally.

Methods:

A cross-sectional study of the prevalence of obesity and associated factors among children in Port Harcourt was carried out. A structured questionnaire was used to collect information on weight, height and sociodemographic data from 600 primary school students.

Results:

The study showed an overall 7.16% prevalence of obesity among the children, with 4.3% in public schools and 10% in private schools. Male children in public school had a statistically significantly

higher proportion of obesity, compared to female children ($p < 0.05$). There was a statistically significant association between the occupation of parents in private school and obesity as parents in the professional group had more obese children, 20 (66.67%) [$\chi 2$ (p-value) =9.65 (0.01)]. Similarly, there was a statistically significant association between the socioeconomic class of parents in private schools and obesity in children, as children whose parents are in the upper socioeconomic class were more obese, 19 (63.33%) [$\chi 2$ (p-value) =18.87 (0.001)]. There was also a statistically significant association between sex of child and obesity, as female children in a private school were 2.41 times more at odds of been obese than male children (OR=2.41, p=0.035, 95% CI =1.1-5.2); while in the public school, female children were less likely to be obese (OR=0.17, p=0.023, 95% CI =0.04-0.78).

Conclusion

This study has established that in Nigeria, obesity has become a public health problem, and was found to be significantly associated with socio-demographic and socioeconomic factors.

Keywords: *Obesity, Children, Public School Private School, Prevalence, Port Harcourt*

INTRODUCTION

Obesity is a serious public health problem that is presently affecting both developed, developing and even underdeveloped countries (1). It is also recognized as one of the leading preventable causes of death worldwide with increasing prevalence in both adults and children (2). It is recognized internationally as a serious public health problem that requires urgent action (3). The prevalence of childhood obesity is rising at an alarming rate worldwide to such an extent that it is best described as a global epidemic (2,4). In developing countries, such as Nigeria, it may soon replace undernutrition as the most common public health problem for

infants and children (4), and its increased prevalence, which was initially more marked in developed countries, is now on the rise in developing countries (4). In developed countries, obesity is currently one of the most common diseases of childhood (5). Childhood obesity is a disease process associated with the development of serious medical complications and increased mortality in adulthood (6).

Globally, more than 42 million children under the age of five years were overweight or obese in 2013(7), and 65% of the world's population live in countries where overweight and obesity kills more people than being underweight (8). Obesity once considered a high-income country problem, is now on the rise in low and middle-income countries particularly in urban settings (9), with consequent double burden of disease (10), thus constituting a rapid upsurge in non-communicable disease risk factors (11,12). Many low- and middle-income countries are now facing a double burden of disease, while they continue to deal with the problems of undernutrition and infectious diseases, there is a rapid upsurge in non-communicable disease risk factors such as obesity and overweight especially in urban settings (13). It is not uncommon to find undernutrition and obesity existing side by side within the same community and same household (14). Children in developing countries are more vulnerable to inadequate prenatal, infant and young child nutrition, and are also exposed to a high fat, high sugar, energy-dense, micronutrient poor foods, which tend to be lower in cost but also lower in nutrient quality (15). These dietary patterns in addition to lower levels of physical activity increase the prevalence of childhood obesity while the problem of undernutrition remains in the background (16).

Obesity occurs among boys and girls of all ages, socioeconomic groups, ethnicity and it has long term health and economic

implications. In Africa and other developing countries all around the world, there is a rapid transition from traditional food patterns to westernized or modern world lifestyle.

Thirty-one million children living with obesity are believed to be living in developing countries (8). The prevalence of obesity has more than doubled between 1980 and 2014 (17). In the United States alone, the percentage of children aged 6-11 who were obese increased from 7% in 1980 to 18% in 2012 (5). The average prevalence of obesity in school-age children in sub-Saharan Africa was found to be 2.5% (18). The incidence of obesity among schoolchildren has more than tripled since the 1970s globally, and in developing countries including Nigeria, and an increase in the prevalence of obesity has been observed (3). In Nigeria, a study conducted in Uyo reported a general childhood obesity rate of 11.3% among primary school children, while another study conducted in Benue State reported a prevalence rate of 23.2%.

Family environment and parental knowledge are directly related to obesity occurring in children, therefore parents' recognition of overweight or obesity in their children is very important for a successful intervention (19). Parents are an important influence on child development in many ways, including physical health and weight (20). Parents create environments for children that may foster the development of healthy eating habits and weight, or promote weight gain and other aspects of disordered eating (21). The incidence of obesity and its adverse health consequences are on the rise in Nigeria (12,22). Early data in the middle and later part of the last century suggested a low prevalence in Nigeria (12), but recent reports from various studies indicate an increasing trend (4,23,24). The study, therefore, was carried out to assess the prevalence of obesity

and associated factors in Rivers state, Nigeria.

METHODS

Study Area

The study was conducted in Port-Harcourt, Rivers State, known as the treasure base of the nation. Rivers State is one of the 36 states of the Federal Republic of Nigeria with Port Harcourt as the capital city. Port Harcourt is located in the South-South region of the country and Rivers State is bounded on the South by the Atlantic Ocean, to the North by Imo, Abia and Anambra States, to the East by Akwa Ibom State and to the West by Bayelsa and Delta states. Rivers State has a population of 6,144,673, estimated population projection (Source: National Bureau of Statistics, Nigeria).

Study Design

This is a comparative cross-sectional study that compared the prevalence of obesity among pupils of public and private primary schools.

Ethical Consideration

Ethical approval to carry out the study was obtained from the Ethics committee of the Rivers State Health Care Management Board (RSHCMB). Permission was also obtained from the Ministry of Education/Local Government Authority for public primary schools and proprietors of private primary schools selected for the study. Parents-Teachers Associations of the selected primary schools were informed to get the optimum co-operation of the parents. Parents/guardians of selected pupils were required to complete the informed consent form on behalf of themselves and their wards.

Study Population

The study population consisted of pupils attending public and private primary schools in Port Harcourt City, Rivers State, Nigeria. Pupils whose parents/guardians gave informed consent were selected for the study.

Sample and Sampling

The formula for calculating sample size to determine a difference between two proportions was employed as follows (25).

$$n = \frac{\left\{u\sqrt{[\pi_1(1-\pi_1)+\pi_0(1-\pi_0)]}+v\sqrt{2\pi(1-\pi)}\right\}^2}{(\pi_0-\pi_1)^2}$$

Where

n = minimum required sample size

u = One-sided percentage point of the normal distribution corresponding to 100% minus the power. Thus at power of 80%, u = 0.84 (Type 2 error). The power is the probability of finding a significant result; for example, if

v = Percentage point of the normal distribution corresponding to the two-sided significance level. Thus at 5% significance level, v = 1.96 (Type 1 error).

The prevalence of obesity as reported in a study done in an urban city Nairobi, Kenya comparing overweight and obesity among students of public and private primary school pupils (26) was used in calculating the minimum required sample size. Nairobi is a rapidly growing and industrialized urban city in one of the developing African countries as Nigeria.

π_1 = prevalence of obesity in Private schools = 10.9%

π_0 = prevalence of obesity in Public schools = 2.2%

$$n = \frac{\left\{u\sqrt{[\pi_1(1-\pi_1)+\pi_0(1-\pi_0)]}+v\sqrt{2\pi(1-\pi)}\right\}^2}{(\pi_0-\pi_1)^2}$$

= 140 students in each study arm

Total = 280 Primary school children

With a 10% non-response rate = 280 + 28 = 308 = 308 primary school children

To increase the validity of the study, a total sample size of 600 was used, 300 students from private and public schools respectively. One out of the two local government areas (LGAs) making up Port-Harcourt city was selected by simple random sampling.

Primary schools were stratified into privately owned and publicly owned primary schools. The sampling frame used was the list of private and public schools in the selected LGA in Port-Harcourt city and the list was

collected from the State Ministry of Education. There are 52 public primary schools and 124 private primary schools in the selected Obio/Akpor local government area. Using sampling with probability proportional to size, two government owned primary schools were selected randomly from the total list of public schools and four privately owned private schools were also randomly selected from the total list of private primary schools in Obio/Akpor LGA. In majority of the private schools in Port-Harcourt, classes end at primary five (Basic five) and in each class arm (A-E), there is an average number of 15-18 pupils per class. In public schools, classes end in primary six (Basic six) and in each class arm, there is an average number of 25-30 pupils/class. A class arm (which ranges from A-E) was selected using a simple random sampling (SRS) process. A list of paper, on which was written the five arms A-E, was split and put in a bowl where the SRS selection took place. This was done for class I-V in private schools and class I-VI in public school. In each arm of the class that was selected, all the pupils in that class whose parents had given consent was selected for the study.

Data collection

Data was collected with the aid of a semi-structured, data collection form focusing on socio-demographic characteristics and socioeconomic status of the parents as adapted from a previous study (14). The data forms were properly sealed in an envelope and given to each child whose parents had given consent to deliver to them at home and return after completion. The pupils' anthropometric measurements were taken after they returned completed questionnaires and results recorded on the same questionnaire. The parent's belief, knowledge, diet, practice and related factors were also evaluated using the same data forms.

Data Analysis

Data were checked for completeness and accuracy and coded data were entered into the computer and analyzed using SPSS version 21 software. WHO AnthroPlus software was used to calculate Z scores of Weight for age (WA), Height for age (HA) and Body Mass Index for age (BMIA). General characteristics was described with descriptive statistics, data were summarized using means and standard deviation. The percentage was used to estimate the prevalence of obesity. The frequency distribution of all the relevant variables was made. The chi-squared statistic was used to test for differences in proportion. A bivariate logistic regression was used to measure the association between the presence of obesity and independent variables, while the multivariate logistic regression was used to test for confounding issues. A p-value less than or equal to 0.05 ($p \leq 0.05$) was regarded as statistically significant.

RESULTS

Table 1: Socio-demographic characteristics of pupils in public and private primary schools

Variable	**Public (n=300)**	**Private (n=300)**	**χ^2 , df (p-value)**
	n %	**n %**	
Age group (years)			
5 – 7	73 (24.3)	182 (60.7)	81.03,1 (< 0.001)
8 – 10	143 (47.7)	111 (37.0)	6.991,1(0.008)
11 – 13	84 (26.3)	7 (1.7)	76.802, 1 (< 0.001)
Mean age ± SD (years)	9.1 ± 2.2	7.7 ± 1.6	*8.677*,1(< 0.001)*

Sex of child			
Male	150 (50.0)	156 (52.0)	0.240, 1(0.624)
Female	150 (50.0)	144 (48.0)	
Family structure			
Monogamy	274 (91.3)	277 (92.3)	0.200, 1 (0.655)
Polygamy	24 (8.0)	14 (4.7)	2.810, 1 (0.094)
Others	2 (0.7)	9 (3.0)	4.538, 1 (0.033)
Occupational group			
Professional	69 (23.0)	235 (78.3)	183.739,1 (< 0.001)
Skilled	115 (38.3)	50 (16.7)	35.319, 1 (< 0.001)
Unskilled	116 (38.7)	15 (5.0)	99.621, 1 (< 0.001)
Socioeconomic class			
Upper	92 (30.7)	187 (62.3)	60.463, 1 (< 0.001)
Middle	81 (27.0)	89 (29.7)	0.525, 1 (0.469)
Lower	127 (42.3)	24 (8.0)	93.886, 1 (< 0.001)

* S*tudent's t statistic*

Table 1 shows the sociodemographic distribution of the students sampled for the study. In public schools 73 (24.3%) of respondents were in the age group 5-7years, and 182 (60.7%) were in this age group in private schools, and this difference is statistically significant (χ^2=81.030; p-value <0.001). Almost half of the pupils in public schools were within the age group 8-10 years 143 (43.7%). Eighty-four (26.3%) of the pupils were in the age group 11-13 years and 7 (1.7%) in the same age group in private schools, and the difference was statistically significant (χ^2=76.80; p-value <0.001). Mean

age was compared using the student's t statistic and this difference was statistically significant (t=8.677; p-value <0.001). In both groups, males and females were almost equal, as there was no statistically significant difference in the sex of the children (χ^2=0.240; p value=0.624). Differences in the education of parents was statistically significant amongst those that had no formal education (p=0.001), secondary education (p=0.01) and tertiary education (p<0.001). Occupation of the parent was significantly different in both groups (p-value <0.001), likewise a statistically significant difference was observed in those with upper (p<0.001) and lower (p<0.001) socioeconomic status in both groups.

Table 2: Anthropometric indices of pupils in public and private schools

Variable	**Public (n=300)**	**Private (n=300)**	χ^2
	n (%)	**n (%)**	**p-value**
Weight-for-age Z scores			
< -2	6 (2.0)	3 (1.0)	1.015 (0.314)
-2 to +2	260 (86.7)	229 (76.3)	10.623 (0.001)
> +2	34 (11.3)	68 (22.7)	13.655 (< 0.001)
Mean	+0.4± 1.4	+1.1 ±1.3	*6.890*(< 0.001)*
Height-for-age Z scores			
< -2	5 (1.7)	4 (1.3)	0.113 (0.737)
-2 to +2	267 (89.0)	226 (75.3)	19.120 (< 0.001)
> +2	28 (9.3)	70 (23.3)	21.514 (< 0.001)
Mean	+0.5 ± 1.2	+0.9 ± 1.5	*4.087* (< 0.001)*

BMI-for-age Z scores			
< -2	34 (11.3)	12 (4.0)	11.395 (0.001)
-2 to +2	253 (84.3)	258 (86.0)	0.330 (0.566)
> +2	13 (4.3)	30 (10.0)	7.240 (0.007)
Mean	-0.6 ± 1.4	+0.4 ± 1.4	*8.330* (< 0.001)*

* *Student's t statistic*

The anthropometric indices measured were Weight-for-age Z (WA), Height-for-age Z (HA) and BMI-for-age Z (BMIA). The majority of the pupils were within -2 to +2 SD in public schools, and more than three-quarters of the students were within -2 to +2 SD in private schools. The frequency of BMIA score (<-2 SD) in public schools, 34 (11.3%) was significantly higher than those for private schools, 12 (4.0%) ($p<0.001$), and > +2 SD was statistically significantly higher in private schools, 30 (10.0%) compared to public schools, 13 (4.3%). There was however no statistically significant difference within -2 to +2 SD in public schools, 253 (84.3%) and private schools 258 (86.0%) ($p=0.566$). Chi-square test of proportion across rows showed a statistically significant difference for -2 to +2 SD in WA between public schools, 260 (86.7%) and private schools, 229 (76.3%) ($\chi^2=10.63$; $p= 0.001$), and also >+2 SD between public schools, 34 (11.3%) and private schools, 68 (22.7%) ($\chi^2=13.65$;$p <0.001$). In the measurement of HA, there was a statistically significant higher proportion in public schools, 267 (89.0%) compared to private schools, 226 (75.3%) within -2 to +2 SD ($\chi^2=19.12$;$p <0.001$) but higher in private schools, 70 (23.3%) than public schools, 28 (9.3%) in >+2SD ($\chi^2=21.51$;$p<0.001$). Student t-test statistics were used to test for the difference in the mean values. BMIA showed a statistically significant higher mean

in the private schools 0.4 ± 1.4 compared to the public schools -0.6 ± 1.4 (t=7.24; p<0.01), likewise WA (1.1 ± 1.3 vs. 0.4 ± 1.4) (t=6.89; p<0.001) and HA (0.9 ± 1.5 vs. 0.5 ± 1.2 (t=4.09; p<0.001).

Table 3: Comparison of Prevalence of Obesity

Distribution of Obesity	**Public school**	**Private school**	**Chi-square (p-value)**
Obesity	13 (4.33)	30 (10.0)	7.24 (0.0071)*
No Obesity	287 (95.67)	270 (90.0)	
Total	**300 (100.0)**	**300 (100.0)**	

**distribution is statistically significant (p<0.05)*

Table 3 shows the comparison of the prevalence of obesity between both types of schools. The data showed that 13 (4.33%) of the students in public school were found to be obsese, and 30 (10%) of the students in private school were found to be obese. The Chi-square analysis showed that the prevalence of obesity in private schools was significantly higher (p = 0.0071) compared to the prevalence of obesity in public schools.

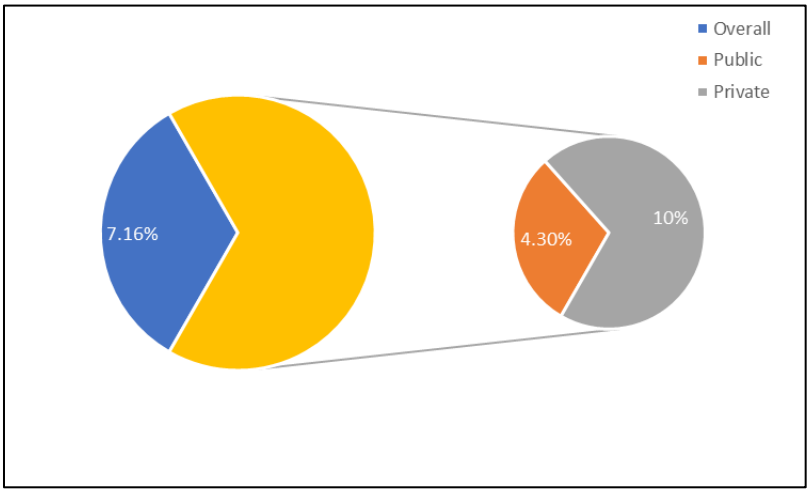

Figure 1: Prevalence of Obesity

Figure 1 shows the prevalence of obesity in this study. The overall prevalence of obesity among the pupils was 7.16%. The prevalence by type of schools showed a 4.3% prevalence in public schools and a 10% prevalence in private schools **Table 4** shows that there was a higher proportion of obesity in children aged between 8-10 years, 19 (44.19%) although this was not statistically significant ($p>0.05$). Female children had a higher proportion of obesity, 22 (51.16%) compared to male children, 21 (48.84%), although this finding too was not statistically significant.

Table 4: Association of socio-demographic characteristics and the presence of obesity

	Obesity			χ^2	**p-value**
	Present	**Absent**	**Total**		
	n = 43	**n = 557**	**n = 600**		
Age of child (year)					
5 – 7	16 (37.21)	239 (42.91)	255	0.704	0.703
8 – 10	19 (44.19)	235 (42.19)	254		
11 – 13	8 (18.60)	83 (14.90)	91		
Sex of child					
Male	21 (48.84)	285 (51.17)	306	0.87	0.7
Female	22 (51.16)	272 (48.83)	294		

Table 5: Association of socio-demographic characteristics of children and presence of obesity in public and private schools

Variable	Public Schools			Private Schools		
	Obesity			Obesity		
	Present	Absent	Total	Present	Absent	Total
	n = 13	n = 287	n = 300	n = 30	n = 270	n = 300
Age of child (year)						
5 – 7	1 (7.69)	72 (25.09)	73	15 (50.0)	167 (61.85)	182
8 – 10	6 (46.15)	137 (47.74)	143	13 (43.33)	98 (36.30)	111
11 – 13	6 (46.15)	78 (27.18)	84	2 (6.67)	5 (1.85)	7
χ^2 (p-value)		***3.152 (0.207)***			***3.669 (0.160)***	
Sex of child						
Male	11 (84.62)	139 (48.43)	150	10 (33.33)	146 (54.07)	156
Female	2 (15.38)	148 (51.57)	150	20 (66.67)	124 (45.93)	144
χ^2 (p-value)		***6.513 (0.011*)***			***4.653 (0.031*)***	

Table 5 shows that there was a higher proportion of obesity in children age between 8-10 and 11-13 years in public schools, 6 (46.15%) and 5-7 years in private schools, 15 (50.0%), although there was no statistically significant difference ($p>0.05$). Male children in public school had a statistically significant higher proportion of obesity, 11 (84.62%) compared to female children, 2 (15.38%) [χ^2 (p-value) =6.513 (0.01)]. For children in private schools, females had a statistically significant higher proportion of obesity, 20 (66.67%) compared to male

children, 10 (33.33%) [χ^2 (p-value) =4.653 (0.03)].

Table 6: Association of Parent's socio-demographic characteristics and the presence of obesity in children.

	Obesity			χ^2	p-value
	Present	**Absent**	**Total**		
	n = 43	**n = 557**	**n = 600**		
Family structure					
Monogamy	42 (97.67)	509 (91.38)	551	2.196	0.334
Polygamy	1 (2.33)	37 (6.64)	38		
Others	0 (0)	11 (1.97)	11		
Occupation group					
Professional	25 (58.14)	279 (91.8)	304	1.886	0.389
Skilled	8 (18.60)	157 (95.1)	165		
Unskilled	10 (23.26)	121 (92.4)	131		
Socioeconomic class					
Upper	24 (55.81)	255 (45.78)	279	4.717	0.095
Middle	6 (13.95)	164 (29.44)	170		
Lower	13 (30.23)	138 (24.78)	154		

Table 6 showed no statistically significant association between parent's socio-demographic characteristics and obesity of their children.

Table 7: Association of socio-demographic characteristics of parents and the presence of obesity in children in types of school

Variable	Public Schools			Private Schools		
	Obesity			Obesity		
	Present	Absent	Total	Present	Absent	Total
	n = 13	n = 287	n = 300	n = 30	n = 270	n = 300
Family structure						
Monogamy	13 (100.0)	261 (90.94)	274	29 (96.67)	243 (90.0)	277
Polygamy	0 (0)	24 (8.36)	24	1 (3.33)	13 (4.81)	14
Others	0 (0)	2 (0.69)	2	0 (0)	9 (3.33)	9
χ^2 (p-value)		***1.289 (0.525)***			***1.195 (0.550)***	
Occupation group						
Professional	5 (38.46)	64 (22.30)	69	20 (66.67)	215 (79.63)	235
Skilled	3 (23.08)	112 (39.02)	115	5 (16.67)	45 (16.67)	50
Unskilled	5 (38.46)	111 (38.67)	116	5 (16.67)	10 (3.70)	15
χ^2 (p-value)		***2.283 (0.327)***			***9.653 (0.008*)***	
Socioeconomic class						
Upper	5 (38.46)	87 (30.31)	92	19 (63.33)	168 (62.22)	187
Middle	3 (23.08)	78 (27.18)	81	3 (10.0)	86 (31.85)	89
Lower	5 (38.46)	122 (42.51)	127	8 (26.67)	16 (5.93)	24
χ^2 (p-value)		***0.395 (0.821)***			***18.870 (< 0.001*)***	

**statistically significant*

There was a statistically significant association between the occupation of parents in private school and obesity as parents in the professional group had more obese children, 20 (66.67%) [χ^2 (p-value) =9.65 (0.01)] as shown in **Table 7**. Also, there was a statistically significant association between the socioeconomic class of parents in private schools and obesity in children, as children whose parents were in the upper socioeconomic class were more obese, 19 (63.33%) [χ^2 (p-value) =18.87 (0.001)]; although no statistically significant association was observed between family structure and education of parents with obesity in children.

Table 8: Bivariate logistic regression of the presence of obesity in school children and socio-demographic characteristics

Variable	**Public school**			**p-value**	**Private school**			**p-value**
	Odds ratio	**95% CI**			**Odds ratio**	**95% CI**		
		Lower	**Upper**			**Lower**	**Upper**	
Age of Child (years) (10-13/5-9)	1.67	0.59	4.75	0.411	2.39	0.79	6.95	0.08
Sex of child (Female/Male)	0.17	0.04	0.78	0.023*	2.41	1.1	5.2	0.035*
Family structure (Monogamy/Polygamy)	2.0	0.27	11.31	0.428	1.50	0.19	18.91	0.571

**Statistically significant*

There was a statistically significant association between sex of child and obesity, as female children in the private school were 2.41 times more at odds of being obese than male children (OR=2.41, p=0.035, 95% CI =1.1-5.2); while in the public school, female

children were less likely to be obese (OR=0.17, p=0.023, 95% CI =0.04-0.78) as shown in **Table 8**.

No statistically significant association was observed between age and obesity in either public (OR=1.67, p=0.411, 95% CI =0.59-4.75) or private school (OR=2.39, p=0.08, 95% CI =0.79-6.95), and if pupils where from a monogamous or a polygamous family structure and obesity in either a public (OR=2.0, p=0.428, 95% CI =0.27-11.31) or private school (OR=1.50, p=0.571, 95% CI =0.19-18.91).

Table 9 shows the aggregate scores for parental knowledge of respondents in both groups. Two hundred and fifty-nine (86.3%) of the respondents in public schools had >50% score compared to 264(88%) in private schools with the mean score in public schools and private schools 74.9±2.9 and 76.1±21.9, respectively. Student's t-test was used to compare the difference between the means, the difference was not statistically significant at chi-square 0.682 (p-value 0.496).

Table 9: Aggregate scores of parental knowledge about obesity among parents in public and private schools

Variable	Public (n=300)	Private (n=300)	χ^2 p-value
	n %	**n %**	
Knowledge score (%)			
< 50	41 (13.7)	36 (12.0)	0.372, (0.542)
≥ 50	259 (86.3)	264 (88.0)	
Mean (±sd)	74.9± 2.9	76.1 ± 21.9	*0.682*(0.496)*

*Student's t statistic**

Table 10 shows the relationship between parental knowledge of obesity and the presence of obesity in the children of public and private schools. Using chi-square as the test of significance, there was no statistically significant relationship in the difference in both groups.

Table 10: Association between parental knowledge of obesity and the presence of obesity in children in public and private schools

Variable	Public Schools		Private Schools		
	Present	**Absent**	**Present**	**Absent**	**MHχ^2**
	n = 13	**n = 287**	**n = 30**	**n = 270**	**(pvalue)**
Parental knowledge					
Good	12 (92.31)	247 (86.06)	29 (96.67)	235 (87.04)	2.631 (0.104)
Poor	1 (7.69)	40 (13.94)	1 (3.33)	35 (12.96)	
χ^2 (p-value)	*0.411 (0.521)*		*2.371 (0.124)*		

DISCUSSION

The study showed a 7.16% prevalence of obesity among primary school students. The prevalence of childhood obesity in a previous study done in Port Harcourt (27) among pupils of primary schools, using multistage sampling methods is slightly higher but comparable to the prevalence in public schools in the current study. The prevalence observed in the current study is lower than the estimated prevalence in Africa as of 2010 but is comparable to the projected estimated increase by 2020. The prevalence in private schools is comparable to some developed countries like Canada's national prevalence estimates; yet lower than the average prevalence among school-age children in the United States of America (USA). This could be because the urban cities are tending towards westernized lifestyles as obtained in the developed nations. The study also showed a rise in the prevalence of obesity in males in public schools and this is consistent with studies from South Africa (28).

In the present study, the prevalence was higher in girls in private schools, and this agrees with a study done in southwest Nigeria where the prevalence was higher in girls with increasing age than their male counterparts (29). Average prevalence is higher than that of a study in Lagos, Nigeria (12). The prevalence in public schools in this study is higher than that from a similar study in Nairobi, Kenya where the reported prevalence was not as high when compared to the index study in public schools, but rather in private schools. This indicates that urban girls attending private schools are at a higher risk of obesity.

Sex of the child was found to be associated with obesity, with males being more obese than females in public schools, and the reverse noted in private schools (30). Most studies done in Nigeria have found a higher female prevalence of obesity such as a study

in a peri-urban town in Edo state (29). A previous study done in Port Harcourt concluded that there was no significant gender difference in the prevalence of obesity (31) although the overall prevalence was less than what was obtained from this study. The prevalence of obesity in this study has a direct relationship with the socioeconomic status of children in private schools as compared to the socioeconomic status of children in public schools where there was no association. There is growing evidence that the higher the socioeconomic status the higher the risk of obesity in the children especially in urban areas of developing countries, largely because of increased adoption of western lifestyle as urbanization increases in the cities (30). Nonetheless, studies have further demonstrated that as the Gross national product (GNP) of the countries increases, obesity tends to shift towards lower socio-economic groups (25). Economic growth affects different socioeconomic groups differently. The high prevalence of obesity among subjects from a high socioeconomic status could also be explained by the fact that food preparation patterns have changed over time with home- made foods gradually being replaced by more convenient and high calorie ready to eat foods (5) especially in urban areas. Also, historically, children used to take home made lunch to school. Nowadays, high income earners prefer to give pocket allowances to children who will spend it on high sugar containing snacks sold near school premises. In addition, children are a target for the advertisement of fizzy drinks and confectioneries (5), which are easily afforded by the rich parents in developing economies. Poverty usually results in hunger leading to under-nutrition but it is now replaced with a different form of malnutrition occasioned by improved socioeconomic status where there is adequate food but there is a nutritional imbalance. Available and widely promoted foods are energy-dense but nutrient-poor,

overconsumption of which can result in obesity (32). More children from the high socioeconomic background are affected than their peers from the low socioeconomic group. Even though there is no documented evidence, in the past, children used to walk to school, an activity that encourages burning of calories. However, motorized transportation to schools nowadays, a common phenomenon in urban settings, which is easily affordable by parents of a higher socioeconomic status, could contribute to some extent in lowering physical activity levels in children. Also children now spend more hours in sedentary activities like television watching, which has been associated with being overweight and obese in developed and developing countries (22-26).

Knowledge of a problem is usually assumed as a catalyst towards preventive efforts to minimize the problem (24). In this study parents in public and private schools had good knowledge about obesity. This goes to highlight the fact that knowledge alone is not enough in effecting a meaningful change in preventing childhood obesity but the knowledge should be translated into daily practice (25). Assessing knowledge of parents may be a good starting point to combat the increasing trend of childhood obesity but the encouragement of an obesogenic environment through the role of the media should not be overlooked. Peer pressure is also another influence as found in a study done in Canada (27,28). Despite a good knowledge score of parents on nutrition and obesity-related issues, the prevalence of childhood obesity has continued to rise to show it is not only parents that influence the behaviour of children (31,32).

A study done in the USA on nutrition knowledge and practice revealed that most African American women have good nutrition knowledge, although eating healthy food was difficult for them (32). Various

reasons proffered include the time needed to prepare a healthy meal as well as the cost of the food. Most readily available energy-dense foods in our environment have become staple foods because they are cheap and convenient; an example is instant noodles which is fast becoming a staple food in this country. Some other reasons include the fact that parents hardly have time to stay in the house to prepare healthy meals because of the attendant effects of urbanization, increasing the number of women in the labour market causing a shift in family eating patterns. The manner in which children learn about nutrition knowledge is different from adult learning of nutrition. Children may learn about new foods through repeated exposure, for example exposure to a variety of fruits and vegetables in the home, which is also associated with greater acceptance, preference for and intake of these foods (18). Young children may also develop an under-standing of what are 'normal' eating behaviours by observing the actions of adults who are familiar to them, particularly parents (19). For example, by observing that fruits and vegetables are readily available in the home and that these foods are regularly consumed by the family, children become familiar with these as a key component of the diet. This understanding can be manifested in a young child's nutrition knowledge. The converse scenario may be posited when snack foods and soft drinks are readily available and consumed in place of healthy foods. Children may also learn about food and nutrition from direct discussion of this topic with their parents. It is noteworthy that positive messages emphasizing why food is important may have a greater influence on improving children's nutrition knowledge than negative messages such as why certain foods should not be eaten; and the quantity, quality and specificity of the information provided is significantly related to children's nutrition knowledge.

CONCLUSION

This study has established that in Nigeria obesity has become a public health problem, and was found to be significantly associated with socio-demographic and socioeconomic factors. The prevalence of obesity among Nigerian children from the two different settings was observed, as pupils in private schools were more obese compared to pupils in public schools. These findings have serious implications for policy and planning of nutrition intervention programs for school-aged children in Nigeria; which also tends to support the finding that the developing world, including Nigeria is not excluded from the global rising epidemic of childhood obesity.

RECOMMENDATIONS

Parents should be encouraged to monitor the eating habits of their children so as to develop and promote lifelong healthy eating habits. Adequate and regular physical activity should be incorporated into daily activities of school children with particular emphasis on sporting activities in schools. This positive attitude towards sporting activities from childhood will in turn produce physically active adults.

LIMITATIONS OF THE STUDY

The geographic spread of the participants' addresses limited the possibility of interviewing the parents of each pupil.

REFERENCES

1. Cluss PA, Ewing L, King WC, Reis EC, Dodd JL, Penner B. Nutrition knowledge of low-income parents of obese children. Transl Behav Med [Internet]. 2013 Jun [cited 2020 Mar 22];3(2):218–25. Available from: http://www.ncbi.nlm.nih.gov/pubmed/24039639
2. Muhammad S Mijinyawa SMYMY. Overweight and Obesity among Adolescents in Kano, Nigeria. *J Metab Syndr. 2013*;**02**:1–5.
3. Amidu N, Owiredu W, Saaka M,

Quaye L, Wanwan M, Kumibea P, et al. Determinants of childhood obesity among basic school children aged 6 – 12 years in Tamale Metropolis. *J Med Biomed Sci. 2013* Nov 21;**2**(3).

4. Akarolo-Anthony SN, Willett WC, Spiegelman D, Adebamowo CA. Obesity epidemic has emerged among Nigerians. BMC Public Health [Internet]. 2014 May 15 [cited 2020 Mar 22];14(1):455. Available from: http://bmcpublichealth.biomedcentral.com/articles/10.1186/1471-2458-14-455
5. Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: International survey. *Br Med J. 2000* May 6;**320**(7244):1240–3.
6. Van Niekerk SM, Grimmer K, Louw Q. The prevalence of underweight, overweight and obesity in a multiracial group of urban adolescent schoolchildren in the Cape Metropole area of Cape Town. *South African J Clin Nutr. 2014*;**27**(1):18–24.
7. Disease C, Waters S, Wang B, Online N, Bbc UK. Factsheet on childhood obesity. Heal (San Fr. 2006;(October).
8. Obesity and overweight [Internet]. [cited 2020 Mar 22]. Available from: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight
9. World Health Organization. Social determinants of health and well-being among young people. Health Behaviour in school-aged children study. 6th ed. Currie C, Zanotti C, Morgan A, Currie D, de Looze M, Roberts C, et al., editors. Copenhagen: *WHO Regional Office for Europe; 2012*. 1–272 p.
10. Cedric P, Wamba F, Oben JE, Cianflone K, Wamba PCF, Enyong Oben J, et al. No Title. 2013 [cited

2020 Mar 22];2013:737592. Available from: http://www.ncbi.nlm.nih.gov/pubmed/23862056

11. Mazarello Paes V, Hesketh K, O'Malley C, Moore H, Summerbell C, Griffin S, et al. Determinants of sugar-sweetened beverage consumption in young children: A systematic review [Internet]. Vol. **16**, *Obesity Reviews. Blackwell Publishing Ltd; 2015* [cited 2020 Mar 22]. p. 903–13. Available from: http://www.ncbi.nlm.nih.gov/pubmed/26252417

12. Akinpelu A O, O OO, Odole A C, Tella B A. Nutritional Status of Nigerian Children from Urban Community Using Different Reference Cut-offs [Internet]. Vol. **17**, www.ajbrui.net *Afr. J. Biomed. Res. 2014* [cited 2020 Mar 22]. Available from: www.ajbrui.net

13. Stott KD. Teachers', parents' and students' perceptions of childhood obesity in the Middle East. Diss Abstr *Int Sect A Humanit Soc Sci* [Internet]. *2014*;**74**(7-A(E)):No-Specified. Available from: http://gateway.proquest.com/openurl?url_ver=Z39.88-2004&rft_val_fmt=info:ofi/fmt:kev:mtx:dissertation&res_dat=xri:pqm&rft_dat=xri:pqdiss:3556562%5Cnhttp://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=psyc11&NEWS=N&AN=2014-99010-286

14. Otinwa GO. Prevalence of Obesity and Predisposition to Metabolic Syndrome among School-Based Adolescents in Botswana and Nigeria. Vol. **9**, *The African Symposium: An On Line Journal Of African Educational Research Network. 2009*.

15. Navti LK, Ferrari U, Tange E, Bechtold-Dalla Pozza S, Parhofer KG.

Contribution of socioeconomic status, stature and birth weight to obesity in Sub-Saharan Africa: Cross-sectional data from primary school-age children in Cameroon. *BMC Public Health [Internet]*. *2014* Apr 7 [cited 2020 Mar 22];**14**(1):320. Available from: http://bmcpublichealth.biomedcentral.com/articles/10.1186/1471-2458-14-320

16. Gupta N, Goel K, Shah P, Misra A. Childhood obesity in developing countries: Epidemiology, determinants, and prevention [Internet]. Vol. **33**, *Endocrine Reviews. 2012* [cited 2020 Mar 22]. p. 48–70. Available from: http://www.ncbi.nlm.nih.gov/pubmed/22240243
17. Harper MG. Childhood obesity: Strategies for prevention. *Fam Community Heal. 2006;***29**(4):288–98.
18. Muthuri SK, Francis CE, Wachira L-JMJM, LeBlanc AG, Sampson M, Onywera VO, et al. No Title [Internet]. Dasgupta K, editor. *PLoS ONE Public Library of Science; Mar 27, 2014* p. e92846. Available from: http://dx.plos.org/10.1371/journal.pone.0092846
19. Huisman JURJS. School characteristics, socio-economic status and culture as determinants of primary school enrolment in India. *NICE Work Pap. 2010*;10(September):1–34.
20. Aljunaibi A, Abdulle A, Nagelkerke N. Parental Weight Perceptions: A Cause for Concern in the Prevention and Management of Childhood Obesity in the United Arab Emirates. *PLoS One [Internet]*. *2013* Mar 26 [cited 2020 Mar 22];**8**(3):e59923. Available from: http://www.ncbi.nlm.nih.gov/pubmed/23555833
21. Wahab KW, Sani MU, Yusuf BO,

Gbadamosi M, Gbadamosi A, Yandutse MI. Prevalence and determinants of obesity - A cross-sectional study of an adult Northern Nigerian population. *Int Arch Med. 2011*;**4**(1):10.

22. Ojofeitimi EO, Olugbenga-Bello AI, Adekanle DA, Adeomi AA. Pattern and determinants of obesity among adolescent females in private and public schools in the Olorunda Local Government area of Osun State, Nigeria: A comparative study. *J Public Health Africa. 2011*;**2**(1):45–9.

23. Musa DI, Toriola AL, Monyeki MA, Lawal B. Prevalence of childhood and adolescent overweight and obesity in Benue State, Nigeria. *Trop Med Int Health [Internet]*. *2012* Nov [cited 2020 Mar 22];**17**(11):1369–75. Available from: http://www.ncbi.nlm.nih.gov/pubmed/22974459

24. 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 [Internet]*. *2012* Aug 7 [cited 2020 Mar 22];**12**(1):616. Available from: http://www.ncbi.nlm.nih.gov/pubmed/22867531

25. Kirkwood BR, Sterne JAC, Kirkwood BR. *Essential medical statistics. Blackwell Science; 2003*. 501 p.

26. Kyallo[1] F, Makokha[1] A, Mwangi[2] AM. Overweight and obesity among public and private primary school children in Nairobi, Kenya. 2013 [cited 2020 Mar 22];5(8A3):85–90. Available from: http://dx.

27. Ene-Obong H. Nutrition science and practice : emerging issues and problems in food consumption, diet quality, and health : an inaugural

lecture of the University of Nigeria, delivered on July 29, 2008. Nigeria: University of Nigeria Senate Ceremonials Committee; 2008.

28. Toriola AL, Moselakgomo VK, Shaw BS, Goon DT. Overweight, obesity and underweight in rural black South African children. *South African J Clin Nutr. 2012*;**25**(2):57–61.

29. Abah SO, Aigbiremolen AO, Duru B, Awunor N, Asogun A, Enahoro F, et al. Prevalence of overweight and obesity among students in private and public secondary schools in a peri-urban Nigerian town. *J Biol Agric Healthc. 2012*;**2**(11):51–7.

30. Ec A, Of E, Ed A. Nutrition Transition in Developing Countries: A Review. *Afrimedic J. 2011*;1–5.

31. Okoh BA, Alikor EA. Prevalence of Overweight and Obesity among Primary School Children in Port Harcourt, Nigeria. Niger *Postgrad Med J [Internet]*. *2015* Mar 1 [cited 2020 Mar 22];**22**(1):9–14. Available from: http://www.ncbi.nlm.nih.gov/pubmed/25875405

32. Drewnowski A. Energy Density, Palatability, and Satiety: Implications for Weight Control. *Nutr Rev [Internet]*. *2009* Apr 27 [cited 2020 Mar 22];56(12):347–53. Available from: http://www.ncbi.nlm.nih.gov/pubmed/9884582