

## Risk Factors for Overweight and Obesity among School-Age Children in Jos, Nigeria

Akinyemi O. D Ofakunrin<sup>1</sup>, Janet I. Obayomi<sup>2</sup>, Bose O. Toma<sup>1</sup>,  
Udochuckwu M. Diala<sup>1</sup>, Ibrahim I. Abok<sup>1</sup>, Selina N. Okolo<sup>1</sup>

<sup>1</sup>Department of Paediatrics, University of Jos / Jos University Teaching Hospital, Jos, Plateau State, Nigeria.

<sup>2</sup>Department of Paediatrics, Northwick Park Hospital, Watford Road, HA0 3UJ, Harrow, United Kingdom.

Corresponding Author: Akinyemi O. D Ofakunrin

### ABSTRACT

**Background:** The prevalence of childhood overweight and obesity is increasing not only in the developed nations but also in the low and middle-income countries. Overweight and obesity are associated with untoward health complications thereby necessitating the need for effective preventive strategies which could largely be achieved if the risk factors, which are thought to vary culturally, are known. Hence, this study assessed the risk factors for overweight and obesity among the school-aged children in Jos, North Central, Nigeria.

**Methods:** This was a cross-sectional study conducted among 600 pupils aged 6-13 years in Jos, Nigeria. Data on socio-demographic characteristics, dietary practices and level of physical activities of the pupils were obtained using pretested questionnaires. Body mass indexes derived from weights and heights measurement were used to assess the prevalence of overweight and obesity. The factors associated with overweight and obesity was determined using multiple logistic regression.

**Results:** The risk factors that were significantly associated with overweight/obesity included parental upper socio-economic status (OR, 1.74; 95% CI: 1.05-2.23), television viewing of more than two hours per day (OR, 1.82; 95% CI: 1.31–2.33), vehicular transport to school (OR, 1.51; 95% CI: 1.21-3.13) and eating out at fast food joints (OR, 1.54; 95% CI: 1.21–1.87).

**Conclusions:** This study has identified some modifiable potential risk factors for overweight and obesity among school-age children in Jos. Therefore, interventions targeting some of these factors could help in prevention and control of overweight/obesity among this age group.

**Keywords:** Risk factors, overweight, obesity, children, Nigeria

### INTRODUCTION

Childhood overweight and obesity are nutritional disorders with global public health importance as a result of their increasing prevalence in both developed and developing countries. <sup>[1]</sup> Globally, over 340 million children and adolescents were estimated to be overweight or obese by the World Health Organization (WHO) in the year 2016. <sup>[2]</sup> The prevalence of overweight and obesity among children and adolescents between the ages of five and nineteen years

has increased by over four folds in the last four decades. <sup>[2]</sup> The increasing trend in the prevalence of childhood overweight and obesity is not limited to the economically advanced nations but it has also been reported in the low and middle-income countries, including Nigeria. <sup>[1,3-4]</sup> The increasing trend in the prevalence of overweight and obesity in the low and middle-income countries has been attributed to economic development with resultant improvement in the disposable

incomes which enables lifestyle modifications that are characterized by more sedentary living and inappropriate dietary habits. [5]

Childhood overweight and obesity are associated with untoward short and long-term health complications. Affected children are often confronted with immediate psychosocial problems such as poor self-esteem and self-image, problems of integration with peers, depression, anxiety and stigmatization. [6] The children are also at an increased risk of future medical complications such as diabetes, coronary heart disease, hypertension, stroke and certain cancers. [7-9]

With the increasing global scourge of overweight and obesity, a cohesive and strategic approach is required to design interventions needed to tackle these problems; and this could be largely achieved by understanding the risk factors for the development of the conditions. Previous studies have documented gender, [10] parental education, [11] high-income family, [12] parental obesity, [13] poor dietary habits, [12] frequency of eating out of home, [10] proximity of fast food restaurants, [14] less active transport to school, [15] sedentary activity like watching of television, [16] and maternal smoking [17] as some of the risk factors for childhood overweight and obesity.

The risk for overweight and obesity is thought to vary culturally, [15] hence there is the need to determine the risk factors locally in order to be able to design effective strategies to combat the problem. This study, therefore, assessed the risk factors for overweight and obesity among the school-aged children in Jos, North Central, Nigeria. The outcome of the study could help the various stakeholders in Jos and Nigeria in the formulation of policies which could help in controlling this increasing scourge.

## **METHODOLOGY**

### **STUDY AREA**

The study was carried out in six primary schools (three public and three

private schools) in Jos, capital of Plateau state in the north-central region of Nigeria. Jos is about 310km from Abuja, the Federal Capital of Nigeria and has an estimated population of 900,000. [18] Based on the records obtained from the State ministry of education, there are 23 public and 46 private schools in Jos.

### **STUDY POPULATION**

This comprised of children aged 6-13 years selected from three private and three public primary schools in Jos.

### **STUDY DESIGN**

This was a cross-sectional study conducted among 600 pupils to determine the risk factors for overweight and obesity among school-age children. Both private and public schools were chosen in order to have a fair representation from the different socioeconomic strata of the society.

### **SAMPLE SIZE DETERMINATION**

The minimum sample size was calculated using the sample size determination formula for cross-sectional study. [19]

$$n = \frac{Z^2(1-p)(p)}{d^2}$$

Where n is the minimum sample size, Z is the normal deviate at 95% confidence interval (1.96), d is the precision of the study set at 0.05 and p is the best estimate of prevalence in the target population expressed as a fraction of 100. The prevalence of obesity among school-age children in a previous Nigeria study of 18% (0.18) was used. [20] A minimum sample size of 600 pupils (300 each from the private and public schools) were recruited after adjustment to cater for non, poor and incomplete responses.

### **INCLUSION AND EXCLUSION CRITERIA**

Apparently healthy pupils aged 6-13 years whose parents/guardians gave consent were recruited into the study. Pupils with obvious lower limb deformity and those on prolonged corticosteroid therapy were excluded.

### **SAMPLING TECHNIQUE**

The pupils were recruited using the multistage sampling technique method. In

the initial stage, the primary schools in Jos were stratified based on ownership into 46 private and 23 public schools. Based on proportionate allocation, a ratio of two private to one public school was selected. Among the selected schools, six schools (three private and three public) were further selected using a simple random sampling technique. In the next stage, proportion to size technique was used to determine the number of pupils to be sampled in each of the schools. This was also further employed to determine the number of pupils to be sampled per arm of each of the schools. A computer-generated table of random numbers was then used to pick the determined number of pupils from the list of the eligible pupils per arm in each of the schools culminating in a total of 300 per group of public and private schools. An equal number of males and females was ensured by gender grouping before the final selection was done.

#### DATA COLLECTION

Data was collected using a validated and pretested structured questionnaire. The questionnaire was given to each of the pupils to complete at home with the help of the parents. The questionnaires were used to obtain socio-demographic data of the pupils and their parents; dietary and social information (lifestyle and level of physical activity) of the pupils. The questions were designed to assess dietary intake and practices (meal consumption, fruits/vegetable intake and eating out at fast food joint etc), physical activities (means of transport to school), and sedentary behaviour (television viewing). Eating out at fast food joint was graded as 'yes' if the frequency was more than two days in a week and 'no' if it was less. The educational and occupational history of the parents were categorized based on Olusanya classification of educational and occupational history in Nigeria. [21] The socio-economic status (SES) of the parents was derived from the mother's educational and father's occupational levels according to Olusanya index scoring method. [21]

However, in this study, SES of 114 families could not be assessed due to non-volunteering of required information specified for this.

Weight and height measurements were taken on every child who met the inclusion criteria by the (already trained) investigators using a portable weighing scale (*Seca* 803, UK) and a mobile stadiometer (*Seca* 213, UK) respectively as previously described. [22] From weight and height measurements, body mass index were calculated as weight (kg) divided by height squared ( $m^2$ ). Overweight and obesity status was determined by the International Obesity Task Force (IOTF) reference by Cole et al. [23]

#### DATA ANALYSIS

The data obtained were analyzed using Epi info statistical software version 3.3.5 The sociodemographic characteristics of the subjects were presented in frequency and percentage. The relationship between socioeconomic factors and overweight/obesity of the study population was compared using Chi-square test. Likewise, the relationship between physical activity, dietary intake and overweight/obesity in the study population was compared using the Chi-square. Multiple logistic regression was used to examine the factors associated with overweight and obesity in the study population including television viewing, mode of transport to school, parents educational and occupational status etc. Odds ratio with 95% confidence interval was used and a p-value of  $< 0.05$  was taken to be statistically significant.

#### RESULTS

There were 600 pupils comprising 254 boys and 346 girls, with a male to female ratio of 1:1.4. The mean age of the pupils was  $9.32 \pm 1.64$  years, with 328 (54.7%) being within the age group of 6-9 years while 272 (45.3%) were in the age group of 10-13 years. Three hundred and twenty-six (67.1%) of the pupils had parents who belonged to the low socioeconomic

class while 59(12%) of the pupils were from high socioeconomic class. Based on the IOTF reference cut off, 62 (10.3%) of the subjects were overweight while 10 (1.7%) were obese. Table 1.

In the analysis of factors associated with overweight and obesity, 64 children who were underweight were removed from the analysis leaving a total of 536 pupils. There was a statistically significant association between parents' education, occupation, socioeconomic class and overweight/obesity among the study population ( $p < 0.05$ ). Children whose parents had tertiary education up to university level and those whose parents were at a high occupational hierarchy were more likely to be overweight or obese compared with those whose parents were less educated or were at a low occupational hierarchy. Similarly, seven (12.5%) of the children from the upper social class were obese compared with three (3.2%) of the pupils from the middle socioeconomic class and none from the lower class, the

difference was statistically significant ( $p < 0.0001$ ). Table 2.

**Table 1: Characteristics of the study population**

Variable	Frequency	Percentage
<b>Age group (years)</b>		
6 -9	328	54.7
10-13	272	45.3
Total	600	100.0
Mean age± SD (years)	9.32±1.64	
<b>Gender</b>		
Male	254	42.3
Female	346	57.7
Total	600	100.0
<b>Family setting</b>		
Monogamous	535	89.2
Polygamous	62	10.3
Single/divorced	3	0.5
Total	600	100.0
<b>Family size</b>		
≤5	227	37.9
6-10	365	60.8
≥10	8	1.3
Total	600	100.0
<b>SES of parents</b>		
Upper	59	12.0
Middle	101	20.9
Lower	326	67.1
Total	486	100.0
<b>BMI status</b>		
Underweight	64	10.7
Normal	464	77.3
Overweight	62	10.3
Obesity	10	1.7
Total	600	100.0

SES = socioeconomic status, SD = standard deviation, BMI = body mass index

**Table 2: The relationship between socioeconomic factors and body mass index status (overweight/obesity) in the study population**

Variable	Body Mass Index Status			Total	$\chi^2$	P
	Normal Freq (%)	Overweight Freq (%)	Obese Freq (%)			
<b>Mothers' educational level</b>						
Up to university level	220(82.7)	38(14.2)	8(3.1)	266		
Secondary or tertiary level below university <sup>a</sup>	160(89.9)	16(9.0)	2(1.1)	178		
No schooling, primary level or adult education only	84(91.3)	8(8.7)	0(0.0)	92		
Total	464	62	10	536	9.9*	0.04
<b>Fathers' educational level</b>						
Up to university level	139(78.1)	33(18.5)	6(3.4)	178		
Secondary or tertiary level below university <sup>a</sup>	111(82.9)	19(14.2)	4(2.9)	134		
No schooling, primary level or adult education only	100(90.9)	10(9.1)	0(0.0)	110		
Total	350	62	10	422	11.8*	0.02
<b>Mothers' occupation</b>						
Professional, top civil servant, politician, businessman	186(79.5)	42(17.9)	6(2.6)	234		
Middle-level beurocrat, technician, skilled artisan, well-to-do trader	172(90.5)	14(7.4)	4(2.1)	190		
Unskilled workers	106(94.6)	6(5.4)	0(0.0)	112		
Total	464	62	10	536	22.4*	<0.0001
<b>Fathers' occupation</b>						
Professional, top civil servant, politician, businessman	135(70.3)	50(26.0)	7(3.7)	192		
Middle level, beurocrat, technician, skilled artisan, well-to-do trader	120(90.2)	10(7.5)	3(2.3)	133		
Unskilled workers	95(97.9)	2(2.1)	0(0.0)	97		
Total	350	62	10	422	48.9*	<0.0001
<b>Socioeconomic class</b>						
Upper	17(30.4)	32(57.1)	7(12.5)	56		
Middle	72(75.8)	20(21.0)	3(3.2)	95		
Lower	261(96.3)	10(3.7)	0(0.0)	271		
Total	350	62	10	422	129.6*	<0.0001

<sup>a</sup> College of education, school of nursing, polytechnic, \*Likelihood ratio Chi-square

The prevalence of overweight and obesity was higher among children who go to school by car /bus, watch television on a daily basis for two or more hours per day than those who walk to school or watch television for less than two hours daily and the difference was significant (p<0.0001). Table 3.

Similarly, children who eat out at fast food joints (41.1%, 7.1%) were more likely to be overweight /obese compared with those that do not eat out (1.1%, 0%). Children who eat fruits and vegetables once in a while were also more likely to be overweight/obese (24.4%, 3.1%) compared with those who eat fruits and vegetables on a daily basis (2.9%, 0%) respectively. Table 3.

Multiple logistic regression analysis of the determinants of overweight/obesity indicated that parental upper socioeconomic class, viewing television more than two hours per day, using car/bus to go to school and eating out at fast food joints were predictive of overweight/obesity (p<0.05) - Table 4. The risk for development of overweight/obesity in pupils who view television daily for more than two hours per day was 1.8 times more than those who view television daily for less than two hours (OR, 1.82; 95% CI: 1.31–2.33). Similarly, the pupils who eat out at fast food joints were 1.5times at risk for developing overweight/obesity compared to those who do not (OR, 1.54; 95% CI: 1.21–1.87). Table 4

**Table 3: The relationship between physical activity, dietary intake and body mass index status (overweight/obesity) in the study population**

Variable	Body Mass Index Status			Total	χ <sup>2</sup>	P
	Normal Freq (%)	Overweight Freq (%)	Obese Freq (%)			
Physical activity						
Transport to school						
Walking	313(96.9)	10(3.1)	0(0.0)	323		
Riding bicycle	2(100.0)	0(0.0)	0(0.0)	2		
Car/bus	149(70.7)	52(24.6)	10(4.7)	211		
Total	464	62	10	536	80.8*	<0.0001
Duration of watching TV per day						
< 2 hours	10(90.9)	1(9.1)	0(0.0)	11		
2- 4 hours	270(98.2)	3(1.1)	2(0.7)	275		
>4 hours	184(73.6)	58(23.2)	8(3.2)	250		
Total	464	62	10	536	80.2*	<0.0001
Dietary intake						
Eat out at Fast food joint						
Yes	73(51.8)	58(41.1)	10(7.1)	141		
No	391(98.9)	4(1.1)	0(0.0)	395		
Total	464	62	10	536	184.2*	<0.0001
Frequency of fruits/vegetables intake						
Daily	33(97.1)	1(2.9)	0(0.0)	34		
Almost Daily	291(94.2)	14(4.5)	4(1.3)	309		
Once in a while	140(72.5)	47(24.4)	6(3.1)	193		
Total	464	62	10	536	51.3*	<0.0001

Freq – frequency, TV – television, \*Likelihood ratio Chi-square

**Table 4: Multiple logistic regression analyses of risk factors associated with overweight/obesity in the study population**

Risk factors	OR	95% CI		P
		Lower	Upper	
Mother’s educational level	1.78	0.78	3.20	0.21
Father’s educational level	1.05	0.71	2.78	0.32
Mother’s occupation	1.20	0.22	1.02	0.06
Father’s occupation	1.15	0.21	1.11	0.06
Socioeconomic class	1.74	1.05	2.23	0.001**
Television viewing	1.82	1.31	2.33	0.0001**
Transport to school	1.51	1.21	3.13	0.02**
Fruits/vegetables intake	1.58	0.94	2.57	0.06
Eat out*	1.54	1.21	1.87	0.0001**

\*Eat out at fast food joints, OR- odds ratio, C- confidence Interval, \*\* statistically significant

## DISCUSSION

The overall prevalence of overweight/ obesity found in this study was 12% (10.3% and 1.7% for overweight and obesity respectively). This prevalence is unacceptably high considering the psychological and medical complications associated with overweight/obesity and the cost of care. [6-9] There is, therefore, the need for concerted effort to address the overweight and obesity menace through the understanding of their determinants.

In this study, evaluation of risk factors for overweight/obesity showed that parental upper socioeconomic class was associated with overweight/obesity in the children. This finding is similar to the reports from previous studies.<sup>[12,24]</sup> In the low and middle-income countries, people from high socioeconomic class are those that are more likely to engage in lifestyle activities that could promote the development of overweight/obesity such as eating out at fast food joints, using vehicles as means of transportation, possessing and watching television. Consequently, in the developing countries like Nigeria, obesity is more common among children whose parents have better socioeconomic status unlike in the developed countries where obesity is commoner among those from the lower socioeconomic class.<sup>[25,26]</sup> Following logistic regression analysis, parental education and occupation were not associated with overweight/obesity in this study. This is in agreement with a Brazilian study,<sup>[15]</sup> where no association was found between parental education and risk of overweight/obesity but it is in contrast with a German study where an association was found.<sup>[11]</sup> These contrasting findings may be due to regional differences which could influence the role of several sociodemographic factors on the risk of childhood overweight/obesity.

This study also found a higher risk for overweight and obesity among children who watched television for more than two hours per day. Time spent viewing television has consistently been shown to be associated with overweight/obese status.<sup>[27-28]</sup> A study in the United State reported that children who watched television for more than five hours per day have a nearly 5-fold increased risk of overweight and obesity compared with those who watched for less than two hours.<sup>[27]</sup> Two mechanisms have been suggested by which television viewing contributes to overweight and obesity. These mechanisms are reduced energy expenditure from reduction in physical activity and /or increased dietary intake,

either during viewing or as a result of food advertising.<sup>[29]</sup> Less active transport to school such as use of cars, buses, as opposed to walking or cycling, was associated with overweight/obesity in this study and this is consistent with previous report.<sup>[15]</sup> This may be related to lower energy expenditure that is associated with less active transportation as against walking or cycling, a form of physical exercise, where energy is expended.

Eating out at fast food joints was also found in this study to increase the risk of being overweight or obese. A similar observation has been previously reported and this may be due to the consumption of energy-dense foods (snacks) and drinks which are readily served at fast food joints.<sup>[10,14]</sup> Furthermore, the prevalence of overweight/obesity was higher in children who had inadequate intake of fruits and vegetables than those who ate fruits and vegetables daily (though not statistically significant following logistic regression). The potential role of fruits and vegetables in preventing overweight and obesity has been reported and it is thought to be related to their relatively low energy density, high content of dietary fibre, and associated increasing satiety effect.<sup>[30]</sup> Other determinants of overweight/obesity especially the non-modifiable risk factors such as ethnicity, gender and genetic influence (parental BMI) were not assessed in this study.<sup>[31]</sup> However, the factors found in this study, which are modifiable, may be appropriate targets for future intervention among the school-age pupils in Jos, Nigeria.

## CONCLUSION

The present study has shown a high prevalence of overweight and obesity and has identified parental upper socioeconomic status, television viewing for more than two hours per day, eating out at fast food joints and use of vehicles to go to school as potential risk factors for overweight and obesity among school-age children in Jos, Nigeria. Understanding the risk factors for overweight and obesity could help in

designing effective preventive and control strategies targeted at some of these risk factors among this age group.

#### ACKNOWLEDGEMENT

We are grateful to the parents, principals, proprietors and the teachers of all the participated schools for the opportunity to work together to improve the health of the future generation. To the wonderful pupils from these schools, we say a big thank you.

**Funding:** None

**Conflict of interest:** None declared

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How to cite this article: Ofakunrin AOD, Obayomi JI, Toma BO. Risk factors for overweight and obesity among school-age children in Jos, Nigeria. *Int J Health Sci Res*. 2018; 8(7):1-8.

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