Prevalence and risk factors of obesity among adolescents in urban and rural secondary schools in Jos

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Abstract

Background: The prevalence of adolescent obesity and overweight is on the increase in both developed and developing countries. This is associated with a rise in the incidence of obesity -related co-morbidities. The most feasible solution lies in the utilization of primary prevention strategies which are targeted at the risk factors for adolescent obesity and overweight. These may vary by geographical location. This study, therefore, assessed and compared the risk factors of obesity/overweight in secondary school students in rural and urban areas of Jos, North Central Nigeria.

Methods: This was a comparative cross-sectional study conducted among 450 adolescents, aged 12-18 years from January to June 2019 in Jos, Nigeria. Data on sociodemographic characteristics was obtained using pretested questionnaires. BMI-for age was determined using the 2007 WHO Body Mass Index chart. Logistic regression analysis was used to show association between the sociodemographic risk factors and overweight/ obesity.

Results: The overall prevalence of overweight and obesity was 6.2% and 1.3% respectively. Gender and parental socio-economic status were found to be independent risk factors for adolescent overweight/obesity.

Conclusion: The prevalence of overweight and obesity is high among secondary school adolescents in Jos, Plateau State. Gender and parental socioeconomic status are independent risk factors for adolescent overweight/obesity. Primary prevention programs which focus on these risk factors could aid in preventing and controlling this scourge.

Key words: Obesity, Overweight, Children, rural, urban, secondary school

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Introduction

Worldwide, a significant upward trend in the prevalence of adolescent obesity has been reported.[1,2] According to the World Health Organization (WHO), in 2022, over 390 million children and adolescents aged 5-19 were overweight including 160 million who were living with obesity globally.[1]

Obesity, which was once thought to be mainly a problem of developed and affluent nations, is now on the increase in developing countries in Africa, Nigeria inclusive.[3] This has been attributed to the progressive "nutrition transition" where traditional, nutrient-rich foods are being replaced by westernized diets which have high levels of sugar and saturated fats but are low in fiber.[4]

The prevalence rates of obesity and overweight range widely from 0.2% to 13.7% and 3.3% to 19.1% respectively.

The increasing prevalence of adolescent obesity and overweight will have an enormous impact on the incidence of obesity-related co-morbidities such as CVD, diabetes mellitus, dyslipidaemia, Blount's disease and depression, The disabilities caused by obesity- related co-morbidities are very costly to manage.[3,5] In developing countries like Nigeria, there is a general lack of infrastructure to effectively manage obesity and its associated comorbidities, an enormous burden being placed on the health care system which if left unchecked, can lead to expenditure that may exceed not only the health budget but affect the provision of other basic social amenities.[3] As such, it has been advocated that prevention is the most feasible option for reducing the childhood and adolescent obesity epidemic.[6]

Thus, this study identified the prevalence of obesity and overweight in addition to their risk factors namely gender, age, parental socioeconomic status, family structure, family setting and sibling number in apparently healthy, secondary school, urban and rural dwelling adolescents in Jos, Plateau State to help policy makers in Jos and Nigeria come up with effective strategies for prevention of childhood/ adolescent obesity.

METHODOLOGY

This comparative cross-sectional study was carried out among adolescents aged 12 -18 years in six public secondary schools (three in the urban area [defined as towns with 20,000 inhabitants or more whose occupation are not mainly agrarian. [7]] and three in the rural area [defined as localities outside of cities and towns with less than 20,000 inhabitants])[8] located in Jos-North, Jos-South and Jos-East Local Government Areas (LGAs) of Plateau State between January to June 2019.

According to the records obtained from the State Ministry of Education, Jos North, Jos South and Jos East LGAs have 22, 20 and 10 public secondary schools respectively.

The sample size was calculated using the stated formula.[9]

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$$n = \frac{(p1q1 + p2q2)(z\alpha + z\beta)^2}{(p2 - p1)^2}$$

Where 'n' is the minimum sample size, 'p' is the best estimate of prevalence in the target population expressed as a fraction of 100. The prevalence of obesity among urban (p1) and rural (p2) adolescents in secondary schools in a previous Nigerian study[10] of 4.1% (0.041) and 0% (0.0) was used. The urban and rural complementary probabilities q1and q2, are 0.959 and 1 respectively. The normal deviate at 95% confidence interval (1.96) is zα. The statistical power of the test set at 80% (0.84) is z. A sample size of 450 adolescents (225 each from the urban and rural public schools) was recruited after adjusting for incomplete, poor and non-response.

Apparently healthy secondary school students aged 12 -18 years from the selected public secondary schools whose parents / caregivers gave consent and students who gave consent were recruited into the study. Study participants who were outside the defined study age range 12-18 years, or unable to comply with the study protocol were excluded from the study.

Ethical approval to conduct the study was obtained from the Research and Ethical Committee of the Jos University Teaching Hospital (JUTH) and the Plateau State Ministry of Education. Verbal consent was obtained from the principals of the selected schools.

A multistage random sampling technique was used to select the study participants. All the three LGAs in Jos (Jos North, Jos South and Jos East LGAs) were included in the study.

Data was collected using a pretested and interviewer- administered questionnaire that underwent face and content validation. The questionnaires were used to obtain the biodata of each child and parents- age as at the last birthday, gender, father's occupation, educational level and income, mother's occupation and educational level, family type-monogamous or polygamous, number of siblings, family setting-married, single, widowed, divorced parents. Each child's social classification was derived using the method proposed by Olusanya et al.[11] The socio-economic status (SES) of the parents was derived from the mother's educational and father's occupational levels according to the Olusanya index scoring method.[11]

Weight and height measurements were taken for every child who met the inclusion criteria by the (already trained) investigators using a portable weighing scale (A&D® Medical Bluetooth precision Health Scale-UC-321PBT-C, USA) and a mobile stadiometer (WESTAR® PT-802, China) respectively as previously described.[12]. From weight and height measurements, body mass index was calculated as weight (kg) divided by height squared (m^2)

All data generated was collated and analysed using SPSS statistical software version 23. Qualitative variables were presented in tables as frequencies and percentages. Chi square test was used as a test of association between the sociodemographic characteristics of the study population Mean and standard deviation were used as summary indices for age, weight, height and BMI while the student's t- test was used as a parametric test of difference between the means of the rural and urban dwelling adolescents respectively.

Logistic regression analysis was used to examine the factors associated with overweight and obesity in the study population. P values of < 0.05 at 95% confidence interval were considered statistically significant.

Results

There were 450 students comprising 146 boys and 304 girls with a male to female ratio of 1:2.03. The mean age of the students was 15.10 ±1.71 years with 86 (19.1%), 260 (57.8%) and 104(23.1) being within the age group of early, middle and late adolescence respectively.

One hundred and ninety-eight (44.0%), 179 (39.8%) and 73 (16.2%) of the adolescents had parents who belonged to the upper, middle and low socioeconomic class respectively. (Table Ia).

Based on the 2007 WHO growth reference chart, 28 (6.2%) of the adolescents were overweight (11[4.9%] urban, 17 [7.6%] rural) while 6 (1.3%) were obese (3[1.3%] urban, 3[1.3%] rural). The overweight prevalence was 4.9% and 7.6% for urban and rural areas respectively. The obesity prevalence was 1.3% for both places of residence. The rural adolescents had a significantly higher mean BMI (20.24 ± 2.82; $p = 0.003$) than the urban adolescents (19.44 ± 2.80) (Table Ib).

Table Ia: Characteristics of the Study population

Variables	Location of subjects		Total
	Urban Frequency (%)	Rural Frequency (%)	n = 450
Gender			
Male	79 (35.1)	67 (29.8)	146(32.4)
Female	146(64.9)	158(70.2)	304(67.6)
Age group (years)			
Early adolescence (12 -13)	34 (15.1)	52 (23.1)	86 (19.1)
Middle adolescence (14 -16)	142(63.1)	118(52.4)	260(57.8)
Late adolescence (17 -18)	49 (21.8)	55 (24.4)	104(23.1)
Parental socioeconomic status			
Low	76 (33.8)	122(54.2)	198(44.0)
Middle	104(46.2)	75 (33.3)	179(39.8)
Upper	45 (20.0)	28 (12.4)	73 (16.2)
Family setting			
Dual parenting	186(82.7)	174(77.3)	360(80.0)
Single parenting	39 (17.3)	51(22.7)	90 (20.0)
Family structure			
Monogamous	194(42.7)	178(79.1)	372(82.7)
Polygamous	31 (13.8)	47 (20.9)	78 (17.3)
Sibling number			
4 or less	96 (42.7)	78 (34.7)	174(38.7)
5 or more	129(57.3)	147(65.3)	276(61.3)
BMI status			
Overweight	11 (4.9)	17 (7.6)	28 (6.2)
Obese	3 (1.3)	3 (1.3)	6 (1.3)
Underweight	16 (7.1)	3 (1.3)	19 (4.2)
Normal	195(86.7)	202(89.8)	397(88.2

Table Ib: Characteristics of the Study population (Means± standard deviation)

Variables	Location				
	Total Mean ±SD	Urban Mean ±SD	Rural Mean ±SD	T	p value
Age (years)	15.10 ±1.71	15.16 ± 1.60	15.04 ± 1.81	0.772	0.440
Weight (Kilograms)	49.88±9.15	49.57± 8.72	50.20 ± 9.57	0.730	0.466
Height (metres)	1.58±0.08	1.59 ± 0.08	1.57 ± 0.07	2.667	0.008*
Body Mass Index	19.84±2.83	19.44 ± 2.80	20.24 ± 2.82	3.024	0.003*

SD- standard deviation * Statistically significant

Gender and parental socioeconomic status were the only risk factors that were significantly associated with overweight/obesity ($p < 0.05$) using univariate logistic regression (Table II).

Females were found to be 5.4 times (OR- 5.413; 95% CI: 1.627-18.011; $p = 0.006$) more likely to be obese or overweight compared to their male counterparts.

Also, those in the upper and middle socioeconomic classes were 3.3 times (OR- 3.340; 95% CI: 1.237-9.021; $p = 0.017$) and 2.5 times (OR- 2.492; 95% CI: 1.048-5.926; $p = 0.039$) more likely to be overweight /obese.

Table II: Univariate logistic regression analysis of sociodemographic factors associated with overweight/obesity for the total study population

Sociodemographic factors	Odds ratio	95%CI	p-value
Age (years)			
12-13	RC		
14-16	1.111	0.431-2.864	0.827
17-18	1.111	0.370-3.336	0.851
Gender			
Male	RC		
Female	5.413	1.627-18.011	0.006*
Parental socioeconomic status			
Low	RC		
Middle	2.492	1.048-5.926	0.039*
Upper	3.340	1.237-9.021	0.017*
Family setting			
Dual parenting	RC		
Single parenting	1.040	0.438-2.471	0.929
Family structure			
Monogamous	RC		
Polygamous	1.024	0.409-2.563	0.960
Sibling number			
4 or less	RC		
5 or more	1.174	0.565-2.437	0.667

RC- Reference category *Statistically significant CI-Confidence Interval

Table III: Multiple logistic regression analysis of statistically significant sociodemographic factors associated with over-weight/obesity for the total study population

Sociodemographic factors	Odds ratio	95%CI	p-value*
Gender			
Male	RC		
Female	5.540	1.650 -18.603	0.006*
Parental socioeconomic status			
Low	RC		
Middle	2.637	1.069-6.326	0.030*
Upper	3.365	1.365-9.635	0.020*

RC- Reference category *Statistically significant CI-Confidence Interval

Multiple logistic regression analysis of the statistically significant sociodemographic risk factors of overweight/obesity (gender and parental socioeconomic status) in the total study population showed that they were predictive of overweight/obesity ($p < 0.05$).

Females were 5.5 times more likely to be obese or overweight than males (OR- 5.5401; 95% CI: 1.650-18.603; $p = 0.006$). Adolescents from the upper and middle socioeconomic classes were 3.4 and 2.6 times more likely to be overweight/obese than those from the lower socioeconomic class (OR- 2.637; 95% CI: 1.096 – 6.348; $p = 0.030$) (OR- 3.365; 95%CI: 1.365-9.635; $p = 0.020$) respectively (Table III).

Table IV: Univariate logistic regression analysis of socio-demographic factors associated with overweight/obesity stratified by place of residence

Sociodemographic factors	Urban			Rural		
	Odds ratio	95% CI	p-value	Odds ratio	95% CI	p-value
Age (years)						
12-13	RC					
14-16	0.955	0.193- 4.716	0.955	1.358	0.417- 4.429	0.611
17-18	1.422	0.245-8.241	0.694	0.941	0.223-3.976	0.934
Gender						
Male	RC					
Female	7.624	0.978 -59.405	0.052	4.179	0.942-18.544	0.060
Parental socioeconomic status						
Low	RC					
Middle	8.871	1.120-70.272	0.039*	1.429	0.461- 4.425	0.536
Upper	3.488	0.307- 39.606	0.313	5.476	1.740- 17.230	0.004*
Family setting						
Dual parenting	RC					
Single parenting	1.326	0.352- 4.993	0.677	0.840	0.268- 2.636	0.766
Family structure						
Monogamous	RC					
Polygamous	1.046	0.223-4.915	0.955	0.942	0.299-2.963	0.918
Sibling number						
4 or less	RC					
5 or more	1.365	0.422-4.211	0.588	0.991	0.378-2.579	0.986

RC- Reference category *Statistically significant CI-Confidence Interval

Table V: Multiple logistic regression analysis of statistically significant sociodemographic factors associated with overweight/obesity stratified by place of residence.

Sociodemographic factors	Urban			Rural		
	Odds ratio	95% CI	p-value	Odds ratio	95% CI	p-value
Gender						
Male	RC					
Female	10.098	1.263 -80.754	0.029*	3.718	0.811- 17.038	0.091
Parental socioeconomic status						
Low	RC					
Middle	11.943	1.464-97.447	0.021*	1.296	0.417- 4.173	0.637
Upper	4.331	0.363- 15.700	0.247	4.790	1.452-15.808	0.010*

RC- Reference category *Statistically significant CI-Confidence Interval

Discussion

In this study, the prevalence of overweight and obesity for the total study population was 6.2% and 1.3% respectively. After stratification by place of residence, overweight was more prevalent in the rural (7.6%) compared to the urban (4.9%) areas whereas the obesity prevalence (1.3%) was the same for both places of residence. The 6.2% prevalence of overweight found in this study is comparable to results in previous Nigerian studies.[13–15]It is however higher than the 0% prevalence reported by Madu *et al.*[16] in Jos, Plateau state in 2004 which is the same location of the extant study. This difference could be due to rapid urbanization and nutrition transition which has been reported among Nigerian children.[17]

The 1.3% prevalence rate of obesity in the current study is comparable to the 1.7% prevalence reported by Ofakunrin *et al.*[18] in Plateau State but higher than the

0.2% reported by Lateef *et al.*[19]in Kwara, all in North Central Nigeria. The higher obesity prevalence in the current study compared to that by Lateef *et al.*[19] in Kwara can be attributed to higher vehicular commuting in Jos to go to school compared to Kwara where majority of public-school students walk to school, increasing their daily activity and reducing their obesity risk.[19]

The higher rural overweight prevalence (7.6%) observed in the present study compared to the urban overweight prevalence (4.9%) is similar to findings made in an Ondo study (rural-7.90%, urban-4.70%).[14] but higher than results from Enugu (rural-4.2%, urban-10.7%)[10] and Ekiti (rural-6.7%, urban-13.2%).[20]

The variations in the nutritional content of the native diet of the rural dwellers may explain the current study finding. Where the diet usually consumed is energy – dense, this can predispose to excessive weight gain.

The similar rural and urban obesity prevalence rate (1.3%) found in this study was different from observations made by other Nigerian authors[10,14] where obesity was either more prevalent in the rural or urban areas. The present study finding can be explained by several emerging factors that are equalizing health risks across both environments namely dietary uniformity as adolescents in both urban and rural areas are increasingly consuming the same energy-dense, high calorie diets, non-exclusivity of sedentary lifestyle to cities alone making for widespread physical inactivity in both environments and a large knowledge gap on causes and prevention of adolescent obesity in both rural and urban areas.[10]

The finding of significantly higher prevalence rates of overweight and obesity among female adolescents in this study is consistent with previous Nigerian studies.[4,21]This may be explained by hormonal changes that occur in adolescence[22] and the difference in the level of physical activity between males and females. Females tend to engage in less physical activity than males[23] due to the differences in body composition, motor skill development, and socialization with regards to sports.[24]

In this study, children from the upper and middle socioeconomic class were more overweight/obese than those from the lower class and the middle and upper socioeconomic classes were predictive of overweight /obesity in the urban and rural areas respectively. The finding of higher odds of overweight/obesity in adolescents from the upper and middle socioeconomic classes agrees with results from previous studies[18,25]but it contrasts with the finding of higher odds of overweight/ obesity in children from the lower socioeconomic class reported in Sokoto [26] and Ekiti.[27] Higher social class in developing countries is associated with higher purchasing power making for easy affordability of high energy dense foods, sweetened beverages, computer games and cable television, all of which contribute to excessive weight gain.

A limitation of this study is that dietary choices were not assessed though they have been documented to play an important role in the pathogenesis of obesity/ overweight.[10]

The study findings highlight the importance of routine screening for obesity/overweight in adolescents, irrespective of the geographical location as well as the need to institute early prevention strategies.

Conclusion

The prevalence of overweight and obesity is high among secondary school adolescents in Jos, Plateau State irrespective of area of residence. Gender and parental socioeconomic status are independent risk factors for adolescent obesity and overweight. Primary prevention programs which focus on these risk factors could help in bringing this health condition under control.

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