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12.7%

12.7% of African children will be overweight by 2020 (WHO, 2015).

20%

Prevalence of overweight and obesity increased by 20% between 2002 and 2010 (WHO, 2010).



OBESITY

A new silent killer disease in town

OVERWEIGHT, OBESITY AND UNDERWEIGHT PROFILE AMONG ADOLESCENT SECONDARY SCHOOL STUDENTS IN UYO, SOUTH-SOUTH, NIGERIA.

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Key Words: Overweight; Obesity; Adolescents; Secondary school; Students; Uyo

ABSTRACT

Background: Adolescent overweight and obesity has more than quadrupled in the last three decades. This has been shown to co-exist with under nutrition. Associated social burden of these nutrition-related disorders including effect on self esteem, body image and economic morbidity should be of concern if a healthy and productive future generation is to be ensured. Primary care providers should constantly assess adolescents for underweight, overweight/obesity risks to enhance early identification and prevention.

Objective: To assess the prevalence of underweight, overweight and obesity among adolescent secondary school students in Uyo, South-South Nigeria.

Method: A multistage-cluster sampling design was used to select participants from private and public secondary schools in Uyo metropolis.

Results: A total of 2257 participants were recruited into the study. This was made up of 576(25.5%) and 560(24.8%) females from public and private schools respectively and 548(24.3%) and 573(25.4%) males in similar distribution. The prevalence of overweight was 12.2% (67/548) and 13.2% (76/573) among the male students in public and private secondary schools respectively while 13.0% (75/576) and 13.6% (76/560) females were correspondingly overweight. Similarly, 3.7% (20/548) and 5.1% (29/573) male students as well as 4.0% (23/576) and 4.6% (26/560) female students in public and private schools respectively were obese. The overall prevalence of underweight was 43.4% while overweight/obesity was 17.4%. Identified risk factors for being either overweight or obesity included being from monogamous family ($p=0.001$), fathers/guardian's occupation ($p=0.0001$), number of siblings <4 ($p=0.0001$) and being in senior secondary school level ($p=0.03$) while risk factors for underweight were having siblings >4 ($p=0.001$), being having either semiskilled or unskilled parent ($p=0.001$) and being in early adolescence ($p=0.001$).

Conclusion: This study demonstrates the existence of the double burden of malnutrition among adolescents in the study area with more boys being under weight, and more girls being overweight and obese. The implication of this is that unless appropriate action is taken to prevent development of adolescent underweight, overweight / obesity and its health sequel, it may be difficult to have a healthy and productive future generation. This can be achieved through introduction of sustained weight maintaining activities and nutrition program among adolescents especially in private schools.

INTRODUCTION

Adolescence is a transitional stage from puberty to adulthood with different stages of development according to different ages within this age range. This is defined as age range of 10-19 years. It is an important period of human life usually characterized by rapid physical, psychological, sexual growth and changes in body fat distribution culminating into adult weight pattern. Aside from a variety of factors such as genetic background, metabolism rate and general physical activity level of the adolescent, nutrition is an important factor that determines weight loss or gain at any given point. Optimum weight of the adolescent is thus a net difference between adequate caloric intake and expenditure. A tilt to either direction may manifest as noticeable weight profile. Overweight(OW) is defined as having excess body weight for a particular height from fat, muscle, bone, water, or a combination of these factors¹. Adiposity of clinical importance may start from childhood through adolescence into adulthood and usually result from imbalance between energy intake and expenditure.

Obesity (OB) on the other hand is a disease, in which fat has accumulated to an extent that health is

adversely affected leading to reduced life expectancy and/or increased morbidity². Obesity usually develops at the extreme of being overweight. This implies that overweight persons are at risk of developing obesity. Overweight and obesity are clinical entities that are found in childhood, adolescence and adulthood in various proportions. It has been shown that the higher the childhood or adolescent's BMI percentile, the greater the risk of being overweight or obese later in life³. BMI values during childhood and adolescence are therefore important risk factors for adult overweight or obesity and the attendant risks of increased morbidity and mortality^{4,5}

Overweight and obesity have been reported to co-exist in many developing countries with underweight^{6,7}. Underweight is defined as BMI of $<5^{\text{th}}$ percentile and generally results from malnutrition. Studies have shown that underweight, overweight and obesity are risk factors for many chronic and non-communicable disorders. Among such disorders include hypertension; Type 2 diabetes mellitus, stroke, arthritis, coronary heart disease, breast and prostate cancers as well as poor pregnancy and other health outcomes^{8,9,10}. Adolescent underweight have

been shown to be risk factor for underweight in adulthood which equally is the primary cause of poor health and mortality during adult life¹¹. Until recently, overweight and obesity was considered as a disease of the affluent affecting the developed world particularly the United States and Europe¹². There has been a paradigm shift between under nutrition and overweight/obesity in the last two decades. For example, while the population of the underfed has declined slightly since 1980 to about 1.1 billion, the number of overweight people has surged to more than 1.1 billion with at least 300 million of them being clinically obese¹³. Worldwide, Underweight, Overweight and Obesity is tending towards epidemic in the general population. As at 2005, it was estimated that over 1.6 billion and 400million people aged 15 years and above were overweight and obese respectively. It is projected that before the end of 2015, this would have grown to 2.3 billion and 700 million for overweight and obese population respectively¹⁴. There is however country to country variation in the prevalence rates of OW and OB. In Europe, 10-27% of men and up to 38% of the women are obese while 28% of men and 34% of women are obese in the United States of America¹⁵. Generally speaking, it is estimated that about 10-20% of children and adolescents in developed countries are obese¹⁶. The prevalence of overweight and obesity in developing countries including Nigeria may not be unconnected with socioeconomic transition and urbanization in these countries which promotes sedentary lifestyles and adoption of unhealthy dietary habits. Under weight on the other hand had been known to be partly related to under nutrition. Genetic factor has been shown equally to play a role either by modifying or enhancing the development of OW/OB¹⁷. Paradoxically poorer people are developing overweight and obesity in many resource poor countries including Nigeria. The paradox of these two extremes, often referred to as the "double burden of malnutrition" co-existing and largely attributable to nutrition transition in low and middle income countries, is a challenge to public health¹⁸. This should send negative alarm signals to health planners to develop an all inclusive intervention plans in our National health policy to check this paradox. This is so because relatively poorer people would be incapable of providing financial needs for care of underweight, overweight/obesity related illnesses. It has been shown that overweight/ obesity is a major contributor to the global burden of chronic non communicable diseases with its associated disabilities. In most Sub-Saharan countries, overweight/Obesity co- existing with under nutrition affect virtually people of all age groups and socio-economic classes¹⁹. Another paradox is that in

most developing countries while HIV/AIDS pandemic, malaria and other infectious diseases continue to attract national and international attention, obesity and prevalence of children/adolescent overweight has tripled since 1980 and yet received no concerted attention for its control²⁰. Adolescence OB just like in adult carries increased levels of cardiovascular risk factors including hypertension, Diabetes mellitus, coronary heart disease and hyperlipidemia²¹. Adolescents who are obese also have been shown to have a greater risk for developing bone and joint disorders, sleep apnea, social and psychological consequences which may be in the form of stigmatization¹⁷. Overweight adolescents may be ridiculed by their peers, nicknamed and sometimes even being discriminated against. This may result in low self-esteem; poor work/ academic performance and school withdrawal/dropout. Underweight adolescents are likely to have low resistance to infections including HIV/AIDS and other STIs, decreased mental development and cognitive achievements with resultant school dropout.

In Nigeria, the national prevalence of adolescent underweight, overweight and obesity is unknown due to inadequate research into this area of adolescent health issues. However few studies have quoted local and regional prevalence including 13.8% and 9.4% for overweight and obesity respectively in Lagos, South West Nigeria²², 9.7% and 1.8% for overweight and obese respectively in Benue, North Central Nigeria²³. Underweight has been found to be 20.0% in Ile-Ife, Nigeria²⁴ and as high as 50% in south Asia.

Studies in developing countries have shown that secondary school students cannot afford quality foods during school sessions hence their over indulgence in disordered eating habits. This is largely made up of energy-dense and micronutrients poor diets such as high consumption of beverages, soft drinks and snacks as foods^{25, 26, 27}. Nigeria is not an exception in this trend. Many students live sedentary lifestyle with reduced physical activity which is largely due to their improved parent's socioeconomic status. A number of them are transported to and fro their schools and on return spend hours playing Video games, watching television or playing computer games²⁸. Aside from possible Genetic predisposition which accounts for about 30-40% of the variations in weight between the individuals, this trend could play an important role in the development of overweight/obesity in this age bracket²⁹.

This study was undertaken to assess the prevalence of underweight, overweight/obesity among adolescent

school students. Knowledge of OW/OB prevalence and early intervention in this age group could reduce or prevent OW/OB in the adult population and their sequelae.

MATERIAL AND METHODS

Study Area

The study was carried out in both Public and Private schools in Uyo urban. Uyo is the Capital of Akwa Ibom state, one of the 36 states in Nigeria. Nigeria is divided into Six (6) geopolitical Zones namely; North-East, North-West, North-Central, South-West, South-East and South-South. Uyo which is divided into eleven (11) administrative wards is located in the South-South geopolitical zone which is referred to as Niger Delta region. At the time of study, there were eleven (11) public secondary schools with a total population of 17,750 and twenty three (23) registered private secondary schools with a total population of 16,314 in the senior classes (JS3-SS2) evenly distributed in the eleven (11) wards.

SAMPLE SIZE DETERMINATION

The minimum sample size was determined using the formula;

$$n = Z^2 P(1-P)/d^2$$

where, $Z=1.96$, corresponding to 95% confidence interval, at $d=5\%$ acceptable margin of error, $p=0.138$, corresponding to 13.8% prevalence of obesity from previous study²². ($n=182$ in each school).

SUBJECTS:

Apparently healthy students aged 10 – 19 years were recruited. In all a total of 2257 students (made up of 1136 girls and 1121 boys) participated in the study. We used clustered sampling design to select six (6) wards in the first stage. In the second stage, two (2) schools i.e. one private and one public were randomly selected in the six (6) wards making a total of twelve (12) schools. For each selected school, the researchers visited the schools ahead of time to intimate the school principal and teachers of the aim of the study and sought for their co-operation. One hundred and eighty two students (based on age group and sex distribution in each school and class) were recruited into the study. Those students who were physically handicapped, having obvious sign of acute or chronic illness or limb deformity were excluded from the study. Pretested Questionnaire was used to obtain information on the socio-demographic characteristics of the respondents before taking their anthropometric measurements which included weight and height measurements. The measurements were taken by the researchers and trained assistants. Participant's biodata were

obtained using structured questionnaire.

ANTHROPOMETRIC MEASUREMENT

Body weights of the respondents were measured using a standard portable bathroom scale. The scale was checked for accuracy after every 10th person. Each respondent's weight was measured to the nearest 0.1 kg wearing light clothing. Respondents were weighed before their mid day lunch break. The respondents' heights were measured to the nearest 0.1 cm using a fixed stadiometer. Each subject's height and weight was measured in a designated room that protected privacy during the procedures. The data were used to calculate the BMI (kg/m^2) of the respondents. The BMI was classified based on age and sex specific cutoffs from the 2000 Centers for Disease Control and prevention growth charts for adolescents³⁰. Thereafter, the BMI so obtained was used to determine those that were underweight (BMI less than the 5th percentile), normal weight (BMI of 5th-85th percentile), overweight (BMI of 85th to less than the 95th percentile) and those that were obese (BMI equals to or greater than the 95th percentile).

Ethical Approval

Ethical approval was obtained from the Research and statistics unit of Akwa Ibom State Ministry of Education. Written consent was obtained from the Principals of all the schools.

PRETESTING OF QUESTIONNAIRE

Pretesting of the questionnaire was carried out prior to commencement of study. This was done in order to identify/correct errors in the questionnaire, ascertain understanding of the questionnaire by the students as well as the adequacy of the questionnaire in collecting the required information from the students. The questions and answers were in English language.

DATA COLLECTION.

Data collection took place from Monday to Friday each week from 10th February to 28th February, 2015 on agreed time in each of the schools. Two teams of research assistants distributed the pre tested questionnaires to the sampled students during each session of survey in their classrooms as well as carried anthropometric measurements from the participants. Participants were adequately assured of the confidentiality of information to be obtained from them.

DATA ANALYSIS

The data so collected were analyzed using Statistical Packaging for Social Sciences (SPSS version 17). Simple descriptive statistical analysis was

performed and the results presented below.

RESULTS

Of the 2257 adolescents, made up of 1136(50.3%) girls and 1121(49.7%) boys aged between 10 and 19 years recruited for the study, a total of 576(25.5%) girls were students of public schools while 560(24.8%) were from private schools. Similarly, 548(24.3%) were boys from public schools while 573(25.4%) were from private schools. The mean age of the girls was 16.4 ± 1.3 and 15.3 ± 1.2 years while the boys were 16.7 ± 1.4 and 16.1 ± 1.3 years for public and private schools respectively. The mean weight of the students was 43.5 ± 10.3 kg and 45.8 ± 9.8 kg for the boys in public and private schools respectively while 42.5 ± 8.9 kg and 39.4 ± 9.1 kg was for the girls in public and private schools respectively. The mean height of the students was 1.57 ± 0.1 M and 1.59 ± 0.3 M for the boys in public and private schools while 1.56 ± 0.2 M and 1.57 ± 0.2 M was for the girls in public and private schools respectively. The mean BMI for all ages was 17.7 ± 3.6 Kg/M² and 18.1 ± 4.0 Kg/M² for the boys in Public and Private schools respectively while the mean BMI for the girls was 17.5 ± 4.0 Kg/M² and 16.0 ± 4.2 Kg/M² for Public and Private schools respectively. The majority of the students, 2242(99.3%) were of Christian religion while Islam and other Religions constituted the rest (0.7%). A greater number of the students, 2254(99.9%) were single while only 3(0.1%) were married. More than

half of them, 1132(50.2%) were in Upper grade classes (Senior Secondary classes S1-S3) while the rest were in lower classes (Junior Secondary classes JS1-JS3). Most of the students, 2125(94.1%) were of the Native/Efik ethnic group while the rest, 132(5.9%) were from the other ethnic Nigerian tribes. Concerning the female respondents, 556(96.5%) and 549(98.0%) of them in public and private schools respectively were from monogamous families while 20(3.5%) and 11(2.0%) were from polygamous families. Similarly, 455(83.0%) and 565(98.6%) of the boys in public and private schools respectively were from monogamous family setting while 93(17.0%) and 8(1.4%) respectively were from polygamous families. Girls whose fathers/guardians were skilled workers were more in private schools, 342(61.0%) with similar trend among the boys, 314(54.8%) whereas, majority of them in public schools, 306(53.1%) and 297(54.2%) for girls and boys respectively had unskilled fathers/guardians. Girls who had 1-4 siblings, were more in private schools, 557(99.5%) compared to 472(82.0%) in the public schools. More boys with 1-4 siblings were in private schools, 561(97.9%) compared to 415(75.7%) in public schools. Similarly, those with >4 siblings were more in the public schools, 133(24.3%) and 104(18.0%) for boys and girls respectively while few 12(2.1%) and 3(0.5%) boys and girls respectively were in private schools.

Table I: Demographic features of adolescent students in both private and public schools

VARIABLE	PUBLIC		PRIVATE		Total =2257 N(%)
	Girls=576 n(%)	Boys=548 n(%)	Girls=560 n(%)	Boys=573 n(%)	
Age (years)					
10-13	158(27.4)	144(26.2)	148(26.4)	150(26.2)	600(26.6)
13-16	176(30.6)	174(31.8)	176(31.4)	182(31.8)	708(31.4)
16-19	242(42.0)	230(42.0)	236(42.2)	241(42.0)	949(42.0)
Mean age(years)	16.4+1.3	16.7+1.4	15.3+1.2	16.1+1.3	
Religion					
Christian	572(99.3)	546(99.6)	559(99.8)	565(98.6)	2242(99.3)
Islam	1(0.2)	-	-	2(0.3)	3(0.1)
others	3(0.5)	2(0.4)	1(0.2)	6(1.1)	12(0.6)
Marital status					
Married	-	-	3(0.5)	-	3(0.1)
Single	576(100.0)	548(100.0)	557(99.5)	573(100.0)	2254(99.9)
Education level					
Junior secondary	280(48.6)	276(50.4)	286(51.1)	283(49.4)	1125(49.8)
Senior secondary	296(51.4)	272(49.6)	274(48.9)	290(50.6)	1132(50.2)
Ethnic group					
Native/Efik	567(98.5)	525(95.8)	501(89.5)	532(92.8)	2125(94.1)
No native	3(0.5)	3(0.5)	31(5.5)	21(3.7)	58(2.5)
Yoruba	1(0.2)	5(0.9)	-	2(0.3)	8(0.4)
Hausa	3(0.5)	2(0.4)	-	1(0.2)	6(0.3)
Others	2(0.3)	13(2.4)	28(5.0)	17(3.0)	60(2.7)
Family setting					
Monogamous	556(96.5)	455(83.0)	549(98.0)	565(98.6)	2125(94.2)
Polygamous	20(3.5)	93(17.0)	11(2.0)	8(1.4)	132(5.8)
Father's occupation					
Skilled	79(13.7)	193(35.2)	342(61.0)	314(54.8)	928(41.1)
Semi skilled	191(33.2)	58(10.6)	30(5.4)	86(15.0)	365(16.2)
Unskilled	306(53.1)	297(54.2)	188(33.6)	173(30.2)	964(42.7)
No. of siblings					
1-4	472(82.0)	415(75.7)	557(99.5)	561(97.9)	2005(88.8)
>4	104(18.0)	133(24.3)	3(0.5)	12(2.1)	252(11.2)
Mean weight, height and BMI.					
Weight(Kg)	42.5(8.9)	43.5(10.3)	39.4(9.1)	45.8(9.8)	
Hcight(m)	1.56(0.2)	1.57(0.1)	1.57(0.2)	1.59(0.3)	
BMI(Kg/m ²)	17.5(4)	17.7(3.6)	16.0(4.2)	18.1(4.0)	
BMI Category					
Underweight (<5 th percentile)	274(50.0)	255(44.3)	237(41.4)	215(38.4)	981(43.5)
Normal weight (5-90 th percentile)	187(34.1)	223(38.7)	231(40.3)	243(43.4)	884(39.2)
Overweight (90-97 th percentile)	67(12.2)	75(13.0)	76(13.2)	76(13.6)	294(13.0)
Obese (>97 percentile)	20(3.7)	23(4.0)	29(5.1)	26(4.6)	98(4.3)

A total of 274(50.0%) of the girls in the public school and 237 (41.4%) in the private schools were underweight. Also, 255 (44.3%) of the boys in public school and 215(38.4%) of the girls in private schools were underweight. Two hundred and thirty one(40.3%) girls and 243(43.4%) boys in the private school had normal weight percentile against 223(38.7%) and 187(34.1%) for boys and girls respectively in the public school. More girls,76(13.6%) in private schools were overweight

against 75(13.0%) in the public schools. Whereas 76(13.2%) and 67(12.2%) boys in the private and public schools respectively were overweight. Obesity was present in 29(5.1%) and 20(3.7%) of boys in private/public schools respectively while 26(4.6%) and 23(4.0%) of the girls in private and public schools respectively were obese. (Table II further shows prevalence of underweight, overweight and obesity stratified by age and sex).

Table II: Prevalence of Underweight (UW),Overweight (OW) and Obesity (OB) among participants stratified by age/sex.

AGE(YRS)	PUBLIC									PRIVATE									
	BOYS			GIRLS			BOYS			GIRLS			BOYS			GIRLS			
N	BMI(±SD)	%UW	%OB	N	BMI(±SD)	%UW	%OB	N	BMI(±SD)	%UW	%OB	N	BMI(±SD)	%UW	%OB	N	BMI(±SD)	%UW	%OB
10-13	127	17.5(3.7)	96(35.0)	8(11.9)	2(10.0)	144	117.0(2.7)	77(30.2)	16(21.3)	5(21.7)	134	16.9(2.7)	89(37.6)	15(19.8)	4(13.8)	139	17.6(3.8)	53(24.7)	5(14.5)
13-16	209	17.8(3.7)	85(31.0)	24(35.8)	7(35.0)	212	17.8(4.0)	97(38.0)	25(33.4)	11(47.8)	218	18.2(4.4)	76(32.1)	28(36.8)	14(48.3)	207	17.9(4.2)	89(41.2)	7(34.0)
16-19	212	18.5(3.7)	93(33.9)	35(52.3)	11(55.0)	220	17.8(4.1)	81(31.8)	34(45.3)	7(30.5)	221	18.3(4.2)	72(30.4)	33(43.4)	11(37.9)	214	19.3(4.1)	73(34.0)	11(5.1)
TOTAL	548	16.0(3.3)	274(50.0)	67(12.2)	20(3.6)	576	17.6(3.6)	255(44.3)	75(13.0)	23(4.0)	573	17.8(3.7)	237(41.4)	76(13.3)	29(5.1)	560	18.3(4.1)	215(38.4)	26(4.6)

As shown in Tables III, there were significant association between some demographic variables and presence of overweight (OW) and obesity (OB) in group stratification. This includes; Monogamous home setting as against polygamous setting($X^2 = 359.48$, p-value = 0.001), Fathers/Guardian's occupation($X^2 = 110.57$, p-value = 0.0001), Number of siblings in the family($X^2 = 153.53$, p-value = 0.0001) and educational level of the students($X^2 = 4.64$, p-value = 0.03). There was no association with

age category and overweight/obesity($X^2 = 5.925$, p-value = 0.05)

Table IV also shows association between some demographic variables and under weight. This includes; being in early adolescent($X^2 = 70.023$, p-value = 0.001), being from unskilled or semiskilled parent($X^2 = 862.703$, p-value = 0.001) and having >4 siblings($X^2 = 129.704$, p-value = 0.001),

Table III: Comparison of Overweight, Obesity with some socio-demographic variables among the subjects

VARIABLE	OW/OB Present n=392 (17.4%)	OW/OB Absent n=1865 (82.6%)	Total N=2257 (100.0%)	X^2	p-value
Age category(years)					
10 -13	78(3.5)	466(20.6)	544(24.1)	5.9253	0.051*
13 - 16	146(6.5)	700(31.0)	846(37.5)		
16 - 19	168(7.4)	699(31.0)	867(38.4)		
Family setting				359.48	0.0001*
Monogamous	289(12.8)	1836(81.3)	2125(94.2)		
Polygamous	103(4.6)	29(1.3)	132(5.8)		
Father's Occupation				110.57	0.0001*
Skilled	149(6.6)	779(34.5)	928(41.1)		
Semi skilled	131(5.8)	234(10.4)	365(16.2)		
Unskilled	112(5.0)	852(37.7)	964(42.7)		
No. of siblings				153.53	0.0001*
1 - 4	278(12.3)	1727(76.5)	2005(88.8)		
>4	114(5.1)	138(6.1)	252(11.2)		
Education level				4.64	0.03
Junior Secondary	176(7.8)	949(42.0)	1125(49.8)		
Senior Secondary	216(9.6)	916(40.6)	1132(50.2)		
	*Statistically	Significant			

Table IV: comparison of underweight with some socio-demographic variable among the subjects

VARIABLE	UWT Present(n-981) (43.4%)	UWT Absent(1276) (56.6%)	Total (N=2257)	X ²	p-value
Age category(years)					
10 -13	365(16.2)	235(10.4)	600(26.6)	79.023	0.001*
13 - 16	338(15.0)	370(16.4)	708(31.4)		
16 - 19	278(12.2)	671(29.7)	949(42.0)		
Family setting				0.701	0.40
Monogamous	919(40.7)	1206(53.4)	2125(94.2)		
Polygamous	62(2.7)	70(3.2)	132(5.8)		
Father's Occupation				862.703	0.001*
Skilled	63(2.8)	865(38.3)	928(41.1)		
Semi skilled	230(10.2)	135(6.0)	365(16.2)		
Unskilled	688(30.4)	276(12.3)	964(42.7)		
No. of siblings				129.704	0.001*
1 - 4	787(34.8)	1218(54.0)	2005(88.8)		
>4	194(8.6)	58(2.6)	252(11.2)		
Education level				0.718	0.4
Junior Secondary	479(21.2)	646(28.6)	1125(49.8)		
Senior Secondary	502(22.3)	630(27.9)	1132(50.2)		

DISCUSSION

The study has shown that there were relatively younger boys and girls in the private schools when compared to those in public schools. This finding may be due to the introduction of free and compulsory education in public schools in Akwa Ibom state since 2009 which allowed even those who may have dropped out of school due to financial constraints to return back to school without age barriers in any class of study. In contrast private schools are fee paying hence in many instances only relatively wealthy parents can afford to enroll their children in such schools. Although there was no statistical significance between age of the respondents, school type and development of overweight and obesity using BMI ($p=0.05$) there was however minimal increases in prevalence of overweight and obesity with increasing age, those in late adolescence being more likely to be either overweight or obese. This is not unexpected since this period corresponds to the stage of physiological pubertal sex hormone surge which consequentially result in accelerated growth by augmentation of growth hormone secretion. This is however at variance with that reported by Manyanga et al³¹ who reported decreased prevalence with increasing age among adolescents in a study involving seven African countries. This findings may be due to the different method of participants selection and study population. The study also showed that the prevalence of obesity was higher among the boys

attending private schools when compared with those in public schools (5.1% versus 3.7%). On the other hand, more girls in private schools were obese compared to those in public schools (4.6% versus 4.0%). The same trend was noted among overweight students with more boys in the private schools being overweight compared to those in public schools (13.2% versus 12.2%) and 13.6% girls in private schools against 13.0% in the public schools. Worthy of note is the fact that most of the public schools are non residential with exception of few while the private are all residential. Generally speaking better amenities are provided in the private schools compared to public schools. These among others include better foods provided by the private school authorities to their students whose parents are made to pay exorbitant fees to enroll them. Again non residential private school students are more likely to be from relatively wealthy parental background hence are likely to be provided with car service that drops and picks them up from school. Also they are more likely to be provided with convenience foods and fast foods which are widely believed to contribute to the epidemic of adolescent overweight and obesity^{32,33,34}. This is suggested from this study which showed that adolescents whose parents were skilled workers arguably with better income were more likely to be overweight/obese ($p=0.001$). Secondly, it is a common site in Uyo metropolis to see most students in non residential public schools either walk or cycle to school daily as against those in

private schools. It has been shown that walking and cycling to school require substantial energy expenditures on daily basis thus providing a means of burning off excess body fat³⁵. This could in part explain the finding in this study with students in the private schools being more likely to be overweight and obese.

Being in senior secondary level showed significant association of being overweight/obese compared to those in the junior secondary level ($p=0.03$). This is not unexpected. Majority of students in the senior classes are in their late adolescence. As young people transit from early adolescence to late adolescence, they gradually gain some independence and take over the responsibility for their own eating habits which include obesogenic sugar-sweetened beverages, pizza, full-fat milk, grain-based desserts, breads, pasta dishes, and savory snacks³⁶. Most of these food items are also lacking in micronutrients.

There was significant association between overweight/obesity and being from polygamous family setting as well as having more than four siblings ($p=0.001$). This finding is at variance with other studies which showed inverse relationship between number of siblings and development of overweight and obesity^{37,38}. The assumption in these studies were that additional sibling(s) might serve as a stimulus for child-to-child interactions, cooperative play, or activities that increase the time each child devotes to physical activity. Another possible explanation is that the amount of food for each child in large families is smaller than that in small families which may decrease the availability of food for each child, resulting in the reduction of the odds for overweight. However, information on total energy intake was not obtained in the present study, further study is necessary to verify our results

Father's occupation showed relationship with tendency to develop overweight/obesity among the subjects. Those students whose fathers were skilled workers were more likely to be either overweight or obese. Being skilled worker parent could imply ability to earn better income and hence provision of sufficient income for the family. It should be stated that in Nigeria like in most developing countries, the traditional male bread winner module is in practice. Parents are gatekeepers by providing or restricting access to food opportunities for the family depending on their financial capabilities. This arguably could translate into quality diets for family members which have been shown to affect weight gain³⁹.

Another important finding is the fact that over 43% of the students were underweight with those in public schools being more at risk compared to those in the private schools. Within this subset of underweight public school students, the prevalence was higher among the boys. This may be due to the fact that in traditional African setting the girl child at early age joins the mother in the kitchen to be taught the art of preparing food for the family. This allows the girl child the privilege of partaking of the prepared meals before the rest of the family members whereas the boy child does not have such an entitlement. Other risk factors included having more than four siblings, being from either unskilled or semi skilled parental background and being younger in age. The paradox of these two extremes existing together has been described as the "Double burden of malnutrition" affecting mainly the low and medium income countries. The trend of underweight tend to suggest the influence of family resources on weight status of the family with the younger adolescents (10-13 years age bracket) being at greater risk compared to older adolescents. Overweight and obesity are associated with sedentary lifestyle and over-nutrition while on the other hand underweight is partly related to under nutrition⁴⁰. Relationships exist between nutrition, cognition and psychosocial behavior of an individual. In order to enhance learning and actualization of optimal potential of the adolescent, proper nutrition is critical in maximizing the brain function. Erikson et al showed that malnourished/stunted and underweight students are more likely to perform poorly academically, socially and emotionally⁴¹. The results of our study have highlighted the existence of both extremes of unhealthy weights in school aged adolescents. of overweight, obesity and underweight.

CONCLUSIONS

This study demonstrates the existence of the double burden of malnutrition among adolescents in the study area with more boys being under weight, and more girls being overweight and obese. The implication of this is that unless appropriate action is taken to prevent development of adolescent underweight, overweight, obesity and their known health sequel, it may be difficult to have a healthy and productive future generation. Understanding the factors associated with unhealthy weights is essential because of the importance of adolescence and the potential negative impacts of adolescence unhealthy weights in adulthood. Prevention strategies should be promoted because of the complexities and costs associated with the treatment of complications of overweight, obesity and underweight.

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