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PREVALENCE, MALE-FEMALE DIFFERENTIALS, AND FACTORS ASSOCIATED WITH OBESITY AMONG ADOLESCENTS IN ABUJA MUNICIPAL AREA COUNCIL (AMAC), NORTH-CENTRAL NIGERIA

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Abstract: Obesity among adolescents continues to rise in developing countries posing a major public health concern. This study investigated its prevalence and predictors among in-school adolescents. A school-based cross-sectional analytical study using multistage sampling to recruit 700 adolescents in Abuja Municipal Area Council (AMAC). Body-mass index (BMI) was measured at 18.5 - <25 for normal weight,20 - < 30 for overweight, and >30 for Obese and compared with the WHO BMI-for-age-z scores for age and same-sex categorization. Eating patterns and Physical activity was measured using a valid questionnaire checklist. Data analysis employed descriptive and inferential statistics at $p<0.05$ level of significance. The prevalence of Obesity was 13.7% (n=96) as 47(13.4%) males and 49(14.0%) females were obese. BMI between males and females, eating pattern variables, and engagement in physical activity were statistically significant (p=00.001) (p=0.001) (p=0.012). Among male adolescents, the bivariate analysis showed that age, father's education and mother's education were associated with obesity. Age and consumption of fried foods were significantly associated with obesity among females. Following binary logistic regression, age was the only significant predictor for obesity among male adolescents while among females, age and eating habits were significant predictors for obesity. The prevalence of obesity is generally low in the study but not uncommon. However, it is a bit higher among females. There is a need for the ministry of health to adopt, contextualise and implement the adolescent guidelines developed by WHO to ensure that the prevalence of obesity does not rise among adolescents as they attain adulthood.

Keywords: obesity, overweight, adolescents, eating pattern, physical activity

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Introduction

Ages 10 to 19 are considered adolescent years (United Nations, 1997). They make up 20% of the world's population, and 80% of them reside in developing nations (United Nations, 1997). In recent years, overweight and obesity have been on the increase across many countries despite countless measures put in place to prevent or reduce the condition (UN, 1997). Childhood and adolescent obesity are linked to a significant decline in quality of life and social stigma, which can cause or worsen melancholy, anxiety, low self-esteem, and shame (Visscher and Seidell, 2001). It is now considered to be the fifth most common cause of death worldwide, a severe public health issue (UN, 1997)

Globally, obesity has epidemic proportions, with at least 300 million people being clinically obese (WHO, 2005).

Obesity and being overweight are caused by several circumstances (Roy, 2017; Williams and Greene, 2018). However, poor dietary practice and the lack of adoption of healthy physical activities are modifiable risk factors for obesity in childhood and adolescence which is ten-fold more prevalent in girls than boys (Fosson and Bryant-Waugh, 1997).

Due to their increased nutritional needs, eating habits, and susceptibility to environmental effects, adolescents are a particularly vulnerable age group in terms of nutrition as competing messages about a healthy lifestyle are being sent by a variety of environmental variables, such as community resources and the media (Williams and Greene, 2018). Because of the impact of their peer groups, they are quite open to trying new meals and fast food as well as a clear case of indiscipline that can be characterized by irregular dietary patterns and late-night eating (Adegoke, 2009).

Although obesity is becoming more prevalent globally, it is doing so more quickly in emerging nations as a result of decreased levels of physical activity and a nutrition transition marked by a trend toward eating a diet heavy in fat, sugar, and refined foods and low in fibre. Healthy eating habits must be prioritized in adolescence as they are a crucial component of physical development, psychosocial growth, and cognitive function as well as the prevention of diet-related chronic disorders in adulthood (McNaughton et al, 2008; Quatromoni et al, 2002). With a population of roughly 190.9 million people and estimated proportional mortality from cardiovascular disease, Nigeria is one of several nations severely deficient in micronutrients like iron, zinc, calcium, and vitamin A (Kurz and Johnson-Welch, 1994; Chukwuonye et al., 2013).

Nigeria has not set up a system for gathering data from the entire community on non-communicable diseases (NCD). Hospital-based statistics on CVD in Nigeria have just been released by the WHO and local researchers (Musa et al, 2012). According to these reports and studies, CVD risk factors such as systemic hypertension are on the rise. These are complications that can be rooted in poor dietary patterns and tackling nutritional correctness early reduces the burden of these NCDs. In Nigeria, the prevalence of overweight teenagers ranged from 20.3% to 35.1%, while the prevalence of obesity ranged from 8.1% to 22.2%, according to a systematic analysis of publications published between 2001 and 2012. Kano had a prevalence of 2.7% for males and 1.9% for female adolescentMusa et al, 2012; Chukwuonye et al, 2013).

Studies were carried out in Nigeria targeting the issue of obesity among adolescents in other parts of the country (Ayoola et al, 2009; Adetunji et al, 2019). These studies however focused only on the prevalence of obesity among adolescents and socio-demographic factors without exploring their dietary patterns and physical activity, which are vital aspects in curbing obesity. The eating patterns and habits of teenagers in Nigeria have not gotten enough attention, despite findings from both developed and developing nations indicating the impact of eating patterns on the rising prevalence of obesity (Adegoke, 2009).

Early detection of adolescents at risk of obesity in very different geographic and cultural populations requires appropriate causes to be investigated, and prevention requires education on nutrition and eating habits (Musa et al, 2012). Prevention is the only viable solution to obesity and health challenges related to unhealthy eating habits and patterns, hence tackling it in the early stages of an individual's life is paramount to ending obesity.

Understanding the food habits and patterns of adolescents in Abuja is necessary. Hence, the findings are useful in providing policy-makers with better information to shape policies related to the health of the Nigerian adolescent, sensitize the general public on better nutrition, especially among adolescents, and fill the gap by the inclusion of dietary patterns, factors contributing to gender differences in childhood obesity prevalence as well as physical activity of the adolescents, especially in Abuja Municipal Area Council where such study has not been given due attention by researchers.

Materials and Method

Study Design

A cross-sectional comparative study to investigate the prevalence and factors associated with Obesity among adolescents in Abuja municipal area council, North Central Nigeria.

Study location

One of the six area councils that make up the federal capital territory of Nigeria is the Abuja Municipal Area Council (AMAC). The city of Abuja was established in 1976 and is situated just to the north of where the rivers Niger and Benue converge. According to the national census of 2006, it has a population of 1,405,201, with 740,489 men and 664,712 women, and a 9.3% annual growth rate. Thus, the projected population for 2016 is 3,190,586.51. Abuja Municipal Area Council is geographically located in the centre of the country between longitude 70 04' 69"E, 70 34'30"E and latitude 90 07'30"N, 80 37' 00"N at an altitude of 1,200 - 1,700 feet above sea level.

There are about 204 public and 70 private secondary schools in the various area councils of Abuja (Kantar et al, 2012). The prestigious honour of housing the Aso-Rock, the seat of governmental authority, belongs to AMAC.

Additionally, the majority of embassies are located inside its boundaries, and the council is also home to the majority of federal government parastatals. The majority of the community's residents are entrepreneurs, businessmen and women, and employees of the government.

Study Population

Male (350) and female (350) adolescents made a total of 700 participants of ages 10 to 19 years in seven selected private and public secondary schools in AMAC, Abuja.

Sampling procedure

In the first stage, simple random sampling by balloting was employed to select Abuja Municipal Area Council (AMAC). In the second stage, using a sampling frame comprising the list of registered secondary schools in AMAC, seven schools were selected using simple random sampling via the use of a computer. In each of the sampled schools in stage 2, stratified sampling was employed in the selection of classes. Each sampled school was stratified by classes into junior secondary and senior secondary school respectively (JS1, JS2, JS3, SS1, SS2, and SS3).

For classes with more than one arm, simple random sampling via balloting was employed in the selection of one arm. Proportionate to-size allocation was used to determine the number of adolescents to be selected per class, thus classes with greater numbers had greater representation and vice versa. Proportionate size allocation involved dividing the total number of students in the selected school by the number of students in class and multiplying by the sample size. In the last stage, stratified sampling via equal allocation was employed in the selection of adolescents. Stratification was by sex. In each class, male and female adolescents were sampled using simple random sampling.

Data collection

A valid pre-tested self-administered questionnaire with a Cronbach alpha score of 0.90 and anthropometric measures was employed for data collection. The physical activity questionnaire was adapted from the physical activity questionnaire for older children and adolescents designed by the College of Kinesiology, University of Saskatchewan (Charan and Biswass, 2013). The assessment of physical activity using this tool is based on a seven-day recall.

Ten qualified research assistants were hired to conduct anthropometric measurements, measuring each person's height with a stiff tape measure following the World Health Organization (WHO) global monitoring of trends and determinants in cardiovascular disease standards.

Height: The participants were instructed to remove their shoes, hats, or scarves, stand with their backs to the tape measure, and hold their heads up so they could stare straight ahead at a place on the opposite wall, head high. The participant's head was covered with a flat rule to press the hair, if any, flat. At the point where the flat rule hit the rigid tape, height was measured to the nearest centimetre and then converted to meters. The heights were measured using a wall sticker for height measurement that was produced by a PCB firm in China.

Weight: Participants were instructed to take off bulky outerwear, empty their pockets, and go onto a weighing scale that was set up on a flat, firm surface to determine their weight. The Omron body sensor was used to assess weight (Omron HBF-510W Full Body Sensor Body Composition Monitor Scale, Made in China). Body mass index (BMI) is often calculated as a weight-to-height ratio for an individual (m2). Using the WHO cut points in kg/m2, the following categories of body mass index

(BMI) are established: normal weight = 18.5 - 25, overweight = 20 - 30, and obese 30. Weight in kilos and height in meters where the two components of anthropometric measurement. Using the formula, the BMI for adults was determined; After the body mass index (BMI) calculation, it was compared against the WHO BMI-for-age- z scores for same-sex and age categorization. WHO BMI-for-age z cut-off categorized obesity as z score >2SD; overweight as z score >1SD, normal z score between -2SD and 1SD, and z score below -2SD is classified as thinness (Mfenyaya et al, 2006; Letamo, 2011).

Data Analysis

The data were processed using bivariate and multivariate analyses using the Statistical Package for Social Sciences (SPSS) Version 21. Tables and charts were used to present the data. While qualitative data were expressed as frequencies and proportions, quantitative variables were summarized as means and standard deviations. The cut-off for statistical significance was $p<0.05$.

Ethical Considerations

The Federal Capital Territory Health Research Ethics Committee, Abuja (FHREC/2018/01/13/12-02-18), granted the study its ethical approval. The study was carried out following accepted ethical standards. Before distributing questionnaires, parents of respondents provided written informed consent. The study preserved data confidentiality and anonymity.

Data was gathered, kept private, and solely utilized for the study. Participants' names were not gathered. Serial numbers were issued to the participants. This technique is being implemented to stop data from being linked to any specific individuals. The survey forms were secured in a locked cabinet. Only the researcher and the data entry clerk had access to the safeguarded computerized data. Age verification was done using the student or class roster.

Study assumption

This study was carried out on the premise that the adolescents sampled for this study were not only knowledgeable about the definition of a healthy diet but they can read and understand the questions posed on the questionnaire.

Results

Socio-Demographic Characteristics of Adolescents in the Study

The mean age ± standard deviation of the 700 adolescents in this study was 13.82±2.40 years, the median age was 14 years with an age range from 10 years to 19 years.

Table 1: Socio-Demographic Characteristics of Adolescents in the Study

	Sex			
	Male (N = 350)	Female (N=350)	Chi	p-value
Variables	Freq. (%)	Freq. (%)	square	
Age(yrs)				
10 – 12	86 (24.6)	93 (26.6)		

13 – 16	188 (53.7)	226 (64.6)	22.687	0.001*
17 – 19	76 (21.7)	31 (8.1)		
Class				
JSS 1	112 (32.0)	83 (23.8)		
JSS 2	45 (12.9)	48 (13.8)		
JSS 3	40 (11.4)	40 (11.5)	9.591	0.047*
SS 1	136 (38.9)	168 (48.1)		
SS 2	17 (4.9)	10 (2.9)		
Mother's Educational Status				
No formal education	14 (4.0)	23 (6.6)		
Qur'anic education	29 (8.3)	19 (5.4)		
Primary education	27 (7.7)	17 (4.9)	6.989	0.136
Secondary education	89 (25.4)	98 (28.0)		
Tertiary education	191 (54.6)	193 (55.1)		
Father's Educational Status				
No formal education	2 (0.6)	3 (0.9)		
Qur'anic education	37 (10.6)	15 (4.3)		
Primary education	10 (2.9)	17 (4.9)	19.568	0.001*
Secondary education	82 (23.4)	56 (16.0)		
Tertiary education	219 (62.5)	259 (74.0)		

*Significant at p<0.05

Anthropometric Indices of Adolescents in the Study

Table 2: Comparison of Anthropometric Indices of Adolescents in the Study

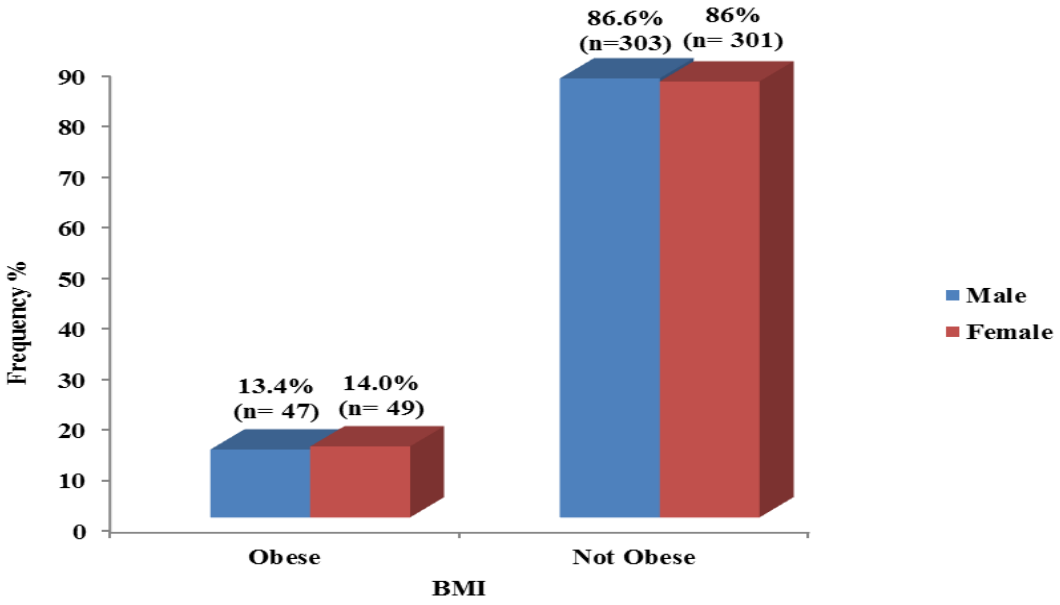
	Sex			
	Male	Female		
Variables	Mean ± SD	Mean ± SD	t-test	p-value
Weight (kg)	48.81±17.01	55.69±14.52	-5.722	0.001*
Height (m)	1.59±0.10	1.58±0.09	1.300	0.194
BMI-for-age Z-score	-0.71±2.64	0.78±1.23	-9.503	0.001*

* SD-Standard deviation *Significant at p<0.05

Table 3: BMI-for-age Z-Classification of Adolescents in the Study

	Sex			
BMI-for-age Z-classification	Male (N = 350) Freq. (%)	Female (N=350) Freq. (%)	Chi square	p-value
Thinness	145 (41.4)	0 (0.0)		
Normal	103 (29.4)	183 (52.3)	190.361	0.001*
Over-weight	55 (15.7)	118 (33.7)		
Obese	47 (13.4)	49 (14.0)		

*Significant at p<0.05



Prevalence of Obesity

Figure I: Prevalence of obesity among male and female adolescents in the study

Adolescents Eating Pattern

Table 4: Distribution of Eating Patterns of Adolescents in the Study

	Sex					
	Male		Female			
Eating Habits	Yes Freq. (%)	No Freq. (%)	Yes Freq.(%)	No Freq.(%)	Chi-square (x2)	p-value
Usually avoids eating fried foods	104 (29.7)	246 (70.3)	69 (19.7)	281 (80.3)	9.405	0.003*
Eats at least one serving of fruit a day	191 (54.6)	159 (45.4)	261 (74.6)	89 (25.4)	30.599	0.001*

Keeps overall fat intake down	254 (72.6)	96 (27.4)	265 (75.7)	85 (24.3)	0.902	0.388
Keeps overall sugar intake down	220 (62.9)	130 (37.1)	236 (67.4)	114 (32.6)	1.611	0.234
Eats plenty of fruit and vegetables	233 (66.6)	117 (33.4)	283 (80.9)	67 (19.1)	18.432	0.001*
Takes one serving of vegetables or salad	137 (39.1)	213 (60.9)	168 (48.0)	182 (52.0)	5.584	0.022*
Has a healthy diet	291 (83.1)	59 (16.9)	315 (90.0)	35 (10.0)	7.078	0.010*

Engagement in Physical Activity

	Sex				
Engagement in physical activities	Male n (%)	Female n (%)	Total n (%)	Chi-Square	p-value
All free time is spent on little physical activity	179 (51.1)	183 (52.3)	362 (51.7)		
I sometimes (1-2 times) engage in physical activity	96 (27.4)	115 (32.9)	211 (30.1)		
I often (3-4 times) engage in physical activity	30 (8.6)	31(8.9)	61(8.7)	12.869	0.012*
I quite often (5-6 times) engage in physical activity	29 (8.3)	9 (2.6)	38 (5.4)		
I very often (≥ 7 times) engage in physical activity	16 (4.6)	12 (3.4)	28 (4.0)		
Total	350	350	700		

Socio-Demographic Factors Associated with Obesity Adolescents

Table 6: Socio-Demographic Factors Associated with Obesity among Male and Female Adolescents

	Male		Female	
Variables	Obese Freq.(..%)	Not Obese Freq. (…%)	Obese Freq.(….%)	Not Obese Freq.(…%)
Age group (years)				
10 – 12 years	19 (40.4)	67 (22.1)	27 (55.1)	66 (21.9)
>12 – 16 years	27 (57.4)	161 (53.1)	21 (42.9)	205 (68.1)
>16 – 19 years	1 (2.1)	75 (24.8)	1 (2.0)	30 (10.0)
	Chi-square = 15.286; p-value = 0.001*		Chi-square = 24.604; p-value = 0.001*	

Fathers Educational Level

No formal education	2 (4.3)	0 (0.0)	0 (0.0)	3 (1.0)
Qur'anic education	1 (2.1)	36 (11.9)	2 (4.1)	13 (4.3)
Primary	3 (6.4)	7 (2.3)	1 (2.0)	16 (5.3)
Secondary	9 (19.1)	73 (24.1)	8 (16.3)	48 (15.9)
Tertiary	32 (68.1)	187 (61.7)	38 (77.6)	221 (73.4)
	Chi-square = 19.568; p-value = 0.001*		Fishers' exact test = 0.850; p-value = 0.858	
Mothers Educational Level				
No formal education	3 (6.4)	11 (3.6)	14 (4.0)	23 (6.6)
Qur'anic education	2 (4.3)	27 (8.9)	29 (8.3)	19 (5.4)
Primary	1 (2.1)	26 (8.6)	27 (7.7)	17 (4.9)
Secondary	14 (29.8)	75 (24.8)	89 (25.4)	98 (28.0)
Tertiary	27 (57.4)	164 (54.1)	191 (54.6)	193 (55.1)
	Chi-square = 16.658; p-value = 0.016*		Chi-square = 6.989; p-value = 0.136	

Eating Patterns and Obesity among Adolescents

Table 7: Association between Eating Patterns and Obesity among respondents

	Male		Female	
Adolescent Eating Pattern	Obese n (%)	Not obese n (%)	Obese n (%)	Not obese n (%)
Usually, avoid Eating Fried Foods				
True	8 (17.0)	96 (31.7)	18 (36.7)	51 (16.9)
False	39 (83.0)	207 (68.3)	31 (63.3)	250 (83.1)
	Chi-square = 4.188; p-value = 0.058		Chi-square = 10.428; p-value = 0.002*	
Eat at least one serving of fruit a day				
True	29 (61.7)	162 (53.5)	35 (71.4)	226 (75.1)
False	18 (38.3)	141 (46.5)	14 (28.6)	75 (24.9)
	Chi-square = 1.114; p-value = 0.346		Chi-square = 0.297; p-value = 0.598	
Keeping overall fat intake down				
True	34 (72.3)	220 (72.6)	40 (81.6)	225 (74.8)
False	13 (27.7)	83 (27.4)	9 (18.4)	76 (25.2)

	Chi-square = 0.001; p-value = 1.000		Chi-square = 1.085; p-value = 0.370	
Keeping overall sugar intake down				
True	27 (57.4)	193 (63.7)	37 (75.5)	199 (66.1)
False	20 (42.6)	110 (36.3)	12 (24.5)	102 (33.9)
	Chi-square = 0.681; p-value = 0.421		Chi-square = 1.694; p-value = 0.250	

Table 7: Association between Eating Patterns and Obesity among respondents (Cont'd)

Eat plenty of fruit and vegetables				
True	34 (72.3)	199 (65.7)	44 (89.8)	239 (79.4)
False	13 (27.7)	104 (34.3)	5 (10.2)	62 (20.6)
	Chi-square = 0.812; p-value = 0.410		Chi-square = 2.941; p-value = 0.116	
One serving of vegetables or salad				
True	18 (38.3)	119 (39.3)	27 (55.1)	141 (46.8)
False	29 (61.7)	184 (60.7)	22 (44.9)	160 (53.2)
	Chi-square = 0.016; p-value = 1.000		Chi-square = 1.151; p-value = 0.355	
Have a healthy diet				
True	40 (85.1)	251 (82.8)	41 (83.7)	274 (91.0)
False	7 (14.9)	52 (17.2)	8 (16.3)	27 (9.0)
	Chi-square = 0.149; p-value = 0.835		fisher's exact p-value = 0.124	

*Significant at p<0.05

Physical Activity and Obesity among adolescents

Table 8: Relationship between Engagement in Physical Activity and Obesity among respondents

	Male		Female	
Engagement in physical activities	Obese n (%)	Not obese n (%)	Obese n (%)	Not obese n (%)
All free time spent on physical activity	26 (55.3)	153 (50.5)	25 (51.0)	158 (52.3)
I sometimes (1-2 times) engage in physical activity	14 (29.8)	82 (27.1)	17 (34.7)	98 (32.7)
I often (3-4 times) engage in physical activity	0 (0.0)	30 (9.9)	7 (14.3)	24 (8.0)
I quite often (5-6 times) engage in physical activity	3 (6.4)	26 (8.6)	0 (0.0)	9 (3.0)

I very often (≥ 7 times) engage in physical activity	4 (8.5)	12 (4.0)	0 (0.0)	12 (4.0)
	Chi-square = 7.029; p-value = 0.129		Chi-square = 5.370; p-value = 0.237	

Multivariate Analysis

Table 9: Multivariate Logistic Regression showing Factors Associated with Obesity among respondents

		95% confidence interval		
Factors**	Adjusted Odds ratio (AOR)	Lower	Upper	p-value
Male Adolescents				
Age	1.31	1.16	1.49	0.0001*
Father's education	1.00	0.66	1.52	0.988
Mother's education	1.08	0.75	1.57	0.672
Female Adolescents				
Age	1.39	1.21	1.60	0.001*
Do not usually avoid eating fried foods	3.75	1.85	7.60	0.0001*

*Statistically significant **Entered as numerical variables

Discussion

The prevalence of obesity

According to the research, 14.0% of women and 13.4% of men were obese. 13.7% was found to be the overall prevalence, which is low and not statistically different between males and females (p=0.413). This is in line with a study (Darebo et al., 2019) that indicated that among Nigerian preschoolers, the prevalence of overweight and obesity was 13.7% and 5.2%, respectively, whereas the prevalence of underweight was 8.5%. However, additional research (Victor et al. 2008; Steyn et al. 2011; Maruf et al. 2013) indicated that BMI was bigger in males during early infancy but larger in females during adolescence, concurring with the index study.

The article went on to imply that females were more likely than boys to become obese from late childhood through adolescence, even though there was no gender difference in the frequency of obesity from childhood through adolescence.

Though the sample sizes varied, other studies conducted globally discovered the same findings about the prevalence of obesity (Musa et al, 2012; Maruf et al, 2013; Yusuf et al, 2013). According to a three-decade narrative review, Nigeria's prevalence rates of obesity and overweight, which ranged from 0.02 to 2.8, were not only lower than those reported from other regions of the world but also remained stable (albeit by significant margins) throughout the study (Ejike, 2014).

Additionally, the results of this study revealed that there was a statistically significant difference in the mean BMI between males and girls (p 0.001). Females were somewhat more likely to be obese

(14.0%) than males (13.4%), although this difference was not statistically significant (p=0.413). This goes contrary to a few other studies that found a statistical difference in obesity between male and female adolescents (UN, 1997; Campbell et al, 2007 Maruf et al, 2013). The studies found that either more female adolescents were at risk of obesity than males whereas more female adolescents were more obese than males or the prevalence of overweight was higher among girls than boys amidst other findings.

Factors associated with obesity

Eating pattern variables of having a healthy diet (p=0.010), eating plenty of vegetables/salad (p=0.001), eating at least one serving of fruit (p=0.001), and not often avoiding fried foods (p=0.003) were significantly different between male and female adolescents. Earlier studies had similar findings (French et al, 1994; Dorostymotlagh et al, 2009; Volrath et al, 2012). However, contrary to these findings, a study carried out in South Africa [66] showed that the frequency of eating at fast-food restaurants did not differ significantly by sex while this index study bivariate analysis showed that age and variable on not often avoiding fried foods were significantly associated with obesity.

Among the female adolescents, binary logistic regression analysis showed that age (Adjusted odds ratio=1.39, 95% CI: 1.21-1.60; p=0.001), and eating habit of not usually avoiding fried foods (Adjusted odds ratio=3.75, 95% CI: 1.85-7.60; p=0.0001) were significant predictors for obesity. This is in agreement with a longitudinal study (Dietz, 2004). Availability of unhealthy foods at home was positively associated with girls' sweet snacks, girls' savoury snacks, and boys' savoury snacks, and in the bivariate analyses, girls' high energy fluid consumption respectively (Campbell, et al, 2007).

Engagement in physical activity showed a significant difference between males and females (p= 0.012). These variations attest to the earlier opinion that Gender differences were present in physical activity patterns (French et al, 1994) as less than half of the proportion of girls as compared to boys achieve the recommended 60 minutes or more of activity per day. Another study (Sallis et al, 2000) examine whether the structured physical activity opportunities of sports team participation and school-based Physical education contributed differently to the physical activity level of girls versus boys, it found that independence of individual-level physical activities varies (Cameron and Getz, 1997).

The overall levels of physical activities of girls and boys are contributed by mainly their involvement and participation in sports teams and physical education class, adolescent boys have been shown to achieve greater physical activity participation during unstructured periods of the day, including recess and after school, than their girl’s counterpart (Cameron and Getz, 1997).

Contrary to our findings, a study in eastern France revealed that there is an inverse relationship between structured physical activity and body mass index among girls in the studied group. Moreover, the study showed that a sedentary lifestyle is associated with a higher body mass index, independent of structured physical activity, in the studied boys and girls (Klein-Platat, 2005), a significant association was seen between both physical inactivity and obesity (Taru et al, 2014).

The age of the adolescents was a crucial factor for overweight and obesity in both boys and girls in the studied group. The early and mid-adolescents among the girls and boys respectively were

observed to be more obese than the rest group. This may be due to inactivity and eating habit among the respective group. More so, the bivariate analysis showed that boys' father's education and mothers' education were associated with obesity.

Following multivariate logistic regression, age was the only significant predictor for obesity in both female and male respondents. Being overweight was more prevalent among younger (≤12) adolescents and decreased with an increase in age as shown by a preceded study (Maruf et al, 2013). It further revealed that underweight prevalence is more among males compared to females, and that underweight tends to increase earlier in the teenage and gradually decreases as one increases in age, 15 – 16 years.

Moreover, among the female adolescents in this study, binary logistic regression analysis showed that age (Adjusted odds ratio=1.39, 95% CI: 1.21-1.60; p=0.001), and eating habit of not usually avoiding fried foods (Adjusted odds ratio=3.75, 95% CI: 1.85-7.60; p=0.0001) were significant predictors for obesity. Female adolescents who do not usually avoid eating fried foods are significantly associated with obesity.

Concerning parents' education level, male adolescents whose father's education was higher were less likely to be obese than those whose mother's education level is high (Odds ratio 1.00; 95% CI: 0.66-1.52).

Female adolescents whose eating pattern comprised of fried food are likely to be more obese than their male counterparts (Odds ratio 3.75; 95% CI: 1.85-7.60).

The study showed that there was a significant difference in the mean BMI between males and females (p=0.001). The prevalence of obesity was higher in females (14.0%) in comparison to males (13.4%) but this was not statistically significant (p=0.413). This is consistent with studies across the globe showing gendered patterning with a greater prevalence and greater heterogeneity in women than in men (Bhuiyan et al, 2013), women are more obese than men(Pelzer et al, 2014), and obesity is more prevalent among women than men in eastern Europe (Wahab et al, 2011), boys and girls differ in body composition, patterns of weight gain, hormone biology, and the susceptibility to certain social, ethnic, genetic, and environmental factors (Malhotra et al, 2008).

However, contrary to these findings was a study that showed in general that obesity was more prevalent among males than females in all countries included in this study (Bhuiyan et al, 2013), and more so, boys had higher odds of being overweight/obese compared to girls within both urban and rural areas(Skinner et al, 2002; Zhang et al, 2018).

Conclusion

Obesity is common among in-school adolescents in AMAC as about 1 in 10 in-school adolescents are obese. Female adolescents have a higher BMI-for-age-Z score in comparison to males. The prevalence of obesity is slightly higher in females in comparison to males.

Further study on the topic is needed to further widen the scope for the whole of Abuja, the federal capital territory to determine the level of prevalence in FCT. Having identified the burden of obesity in adolescents there is a need for the Ministry of Health to develop policies using the adolescent guidelines developed by the WHO and to ensure they are implemented. To increase awareness of

teenage obesity and its risk factors, NGOs and CSOs may launch campaigns that focus on policy-makers, medical professionals, adults, adolescents, and children in general.

Multidisciplinary teams may develop and implement weight management interventions for obese adolescents as part of universal health coverage and support family-based, multi-component lifestyle weight management services for overweight adolescents at healthcare facilities (including nutrition, physical activity, and psychosocial support).

Limitations of the study

The questionnaires did not indicate if the adolescents were leaving with their parents or not. This is because we discovered that some of the students in public schools were domestic helpers. Also, more students were taken from public schools as the majority of the parents in private schools did not give consent. Thus, these could limit the external validity of the study.

Furthermore, the tool was self-administered. This may make it prone to social desirability bias. However, this was minimized by explaining to the respondents the confidentiality of the data and anonymity. They were encouraged to give a truthful response, before filling out the questionnaires.

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Declaration of interest

The authors declare that they have no conflict of interest that may have influenced the findings or report of this study in any way.

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