

## Original Research Article

# Prevalence of Overweight and Obesity among Pharmacy Students in a University in Benin City, Nigeria

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### Abstract

**Purpose:** To identify the prevalence as well as determine gender differences in overweight and obesity among undergraduate pharmacy students of the University of Benin, Benin City, Nigeria.

**Methods:** Undergraduate pharmacy students ( $n = 172$ ) of University of Benin, aged 18 years and above, were recruited for the study. Body mass index, (BMI), waist circumference (WC) and waist/hip ratio (WHR) were measured using standard methods. Blood pressure (BP), and fasting blood glucose (FBG) levels were also measured.

**Results:** The prevalence of overweight and obesity in the sample based on the three anthropometric indices yielded different rates as follows: BMI (10.5 and 1.2 %), WHR (8.1 and 2.3 %), WC (6.9 and 1.7 %), respectively. WHR and WC, but not BMI, reported higher prevalence of overweight among females than males. Only 4 (2.3 %) and 1 (0.58 %) of the subjects had high BP ( $\geq 140/90$  mm Hg) and FBG ( $> 126$  mg/dl).

**Conclusion:** The prevalence of overweight and obesity as well as hypertension and diabetes among pharmacy students sampled is low. Among the overweight and obese, there was no gender difference with regard to BMI. However, WHR and WC revealed that more females compared to males were overweight or obese.

**Keywords:** Overweight, Obesity, Body mass index, Waist-hip-ratio, Anthropometric index, Hypertension, Diabetes

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## INTRODUCTION

Body Mass Index (BMI) is an important anthropometric index that is commonly used for body fat storage status assessment and is used for body fat determination [1]. Another indicator is the waist circumference or abdominal adiposity, which is associated with excess abdominal fat and total body fat. Abdominal adiposity is defined as a waist circumference of  $\geq 102$  cm for men and  $\geq 88$  cm for women. The risk of cardiovascular disease (CVD) and non-insulin dependent diabetes is high in men and women

with abdominal adiposity [2]. Okosun *et al* in their study of six populations of West African descent including Nigeria reported that the prevalence of hypertension was closely linked to abdominal adiposity. These authors further showed that the prevalence of abdominal adiposity and hypertension was more common in women than in men [3]. Excess body fat underlies 64 % of cases of diabetes in men and 77 % of cases in women [5].

Studies of anthropometric measures and prevalence of overweight and obesity among

young adults in African countries particularly in Nigeria are limited. Olufemi and Abiodun in their study of prevalence of overweight and obesity in an institutionalized multi ethnic based male adult sample, reported the prevalence of overweight and obesity among Lagos State University undergraduate male adults to be 14.0 % (BMI: 25 – 29) and 2.3 % (BMI: 30 – 40) respectively [5]. Akinpelu *et al* found that prevalence of overweight was 0 - 8.1 % and 1.3 - 8.1 % in males and females respectively while that of obesity was 0 - 2.7 % and 0 - 1.9 % still in males and females respectively in a sample of Nigerian adolescents in an urban community aged 12-18 years [6]. Similarly, another study of a small sample of students in the University of Port Harcourt reported a prevalence of overweight and obesity of 6.8 % respectively [7]. One study found an alarmingly high prevalence rate of 21 % among undergraduate students in the halls of residence of the University of Nigeria, Nsukka campus [8].

This study therefore seeks to add data to the limited body of knowledge regarding overweight and obesity in young adults in Nigeria. Thus, the objective of this study was to determine the prevalence as well as gender differences in overweight and obesity among undergraduate pharmacy students.

## EXPERIMENTAL

### Study design

This was a cross sectional descriptive study which was undertaken in the Faculty of Pharmacy, University of Benin, Benin City with a student population of 968, and a yearly intake of a maximum of 180 students.

One hundred and seventy-two undergraduate Pharmacy students were recruited into the study by convenience sampling from the 2nd to 5th year class after obtaining verbal informed consent.

### Data collection

Anthropometric measurements of the subjects were taken using standard apparatus. The measurements included weight, height, waist and hip circumference. The weight was measured with calibrated standard electronic weighing scale to the nearest 0.1 kg. Height was measured to the nearest 0.5 cm using a portable meter rule. Body mass index (BMI) was calculated as weight (kg) divided by the square of height ( $m^2$ ) and then categorised according to

WHO recommendations to define underweight (BMI  $\geq$  18.5), healthy weight (BMI, 25.0 - 29.9) and obese (BMI  $>$  30) individual.

Waist circumference was measured at the level of the umbilicus and hip circumference was measured at the widest girth of the hip using a flexible non-stretchable tape. Males with a waist circumference of  $<$  94 cm, 94.0 - 101.9 cm and  $\geq$  102 cm and women with WC of  $<$  80 cm, 80.0 - 87.9 cm and  $\geq$  88 cm were classified as normal weight, overweight and obese respectively. Waist to hip ratio (WHR) was obtained by dividing waist circumference by hip circumference. Men with WHR  $<$  0.95, 0.96 - 1.00 and  $\geq$  1.0 were classified as normal weight, overweight or obese respectively, while women were classified on the basis of WHR  $<$  0.80, 0.81 - 0.85 and  $\geq$  0.85.

Blood pressure was measured, using the standard mercury sphygmomanometer, on the right arm with the subject in the upright sitting position, following at least 5 min rest. The average of two measurements was recorded. Hypertension was defined as systolic blood pressure (SBP)  $\geq$  140 mmHg and diastolic blood pressure (DBP)  $\geq$  90 mmHg.

Fasting blood glucose (FBG) of each subject was measured using a Life Scan One Touch Basic® blood glucose monitoring system. Blood samples were obtained after a minimum of 6 h fast. The results obtained with the glucometer were calibrated with laboratory results using glucose oxidase method. Diabetes was defined as FBG concentration  $>$  110 mg/dl.

### Statistical analysis

Statistical analysis was done using Microsoft Excel. Descriptive statistics for anthropometric characteristics and SBP, DBP and FBG were calculated. Partial correlation coefficient was used to quantify the association between independent variables (BMI, WHR, WC) and dependent variables (SBP and DBP). All tests for statistical significance were two tailed and  $p$ -value set at  $<$  0.05.

## RESULTS

The demographic data of all the subjects are shown in Table 1. There were more females 52.9 % (91) in the study. Half, 86 (50 %) of the subjects were fifth year students. The mean age of the respondents was  $24.38 \pm 3.67$ . Majority 67 (39 %) of the subjects were from Edo State. Other ethnicities are shown in Table 1. Less than

half 22.7 % had a family history of diabetes and hypertension respectively.

Table 2 shows general and gender specific means of anthropometric, Blood Pressure and fasting blood glucose measurements. Males were statistically, older, taller, and heavier  $p < 0.01$ . They also had higher WC, WHR and BP ( $p < 0.01$ ). Female respondents had a higher fasting blood glucose and HC but this was not statistically significant. There was also no significant gender difference with respect to BMI. Pair wise partial correlation between weight, BMI, WC, HC, and WHR was investigated after controlling for age. The result is represented in Table 3. Weight, BMI, WC and HC were generally strongly correlated in both sexes, suggesting that measures of obesity based on these parameters will provide comparable information. However, WHR showed a weaker correlation with other anthropometric measurements.

**Table 1:** Social demographic characteristics of the participants

Variables (%)	Frequency (N)	Percentage (%)
<b>Age</b>		
18-22	42	24.4
23-27	113	65.7
28-32	13	7.6
≥33	4	2.3
<b>Sex</b>		
Male	81	47.1
Female	91	52.9
<b>State of origin</b>		
Edo	67	39.0
Delta	35	20.4
Anambra	30	17.4
Imo	8	4.6
Ondo	8	4.6
Abia	7	4.1
Enugu	6	3.5
Others	11	6.4
<b>Class level</b>		

**Table 2:** Indices of obesity, BP and glucose among respondents

Index	N	Mean ± SD	Female		Male		p-value
			N	Mean ± SD	N	Mean ± SD	
Age	172	24.4± 3.67	91	23.62±3.8	81	25.2±3.3	<0.01
Height	172	1.69± 0.07		1.64± 0.06		1.75±0.06	<0.01
Weight	172	62.7± 9.28		58.8±7.7		67.07±8.9	<0.01
BMI	172	21.86±2.69		21.8±2.7		21.9±2.6	0.64
WC	172	72.7±8.89		69.7± 8.7		76.1±7.8	<0.01
HC	172	92.8 ±7.93		93.0±8.7		92.7±7.0	0.80
WHR	172	0.78 ±0.06		0.75±0.05		0.82±0.07	<0.01
FBG	172	71.2± 13.6		71.5±17.3		70.9±7.76	0.80
Systolic BP	172	107.7 ± 14.2		103.4±12.1		112.7±14.7	<0.0001
Diastolic BP	172	69.4 ± 11.0		67.3±10.3		71.8±11.3	<0.01

500L	86	50
400L	40	23.3
300L	30	17.4
200L	16	9.3
<b>Family history</b>		
Diabetes	39	22.7
Hypertension	38	22.1

Prevalence of overweight and obesity based on BMI was similar in both sexes. In Table 4, WC and WHR measures recorded more females to be overweight and obese compared to males.

Overweight was defined as BMI between 25 - 29.9 and obesity as BMI  $\geq 30$  kg/m<sup>2</sup> in males and females. Overweight was defined based on WC 94 - 101.9 cm and 80 - 87.9 cm in males and females respectively and obesity based on WC  $\geq 102$  cm in males and  $\geq 88$  cm in females. Overweight with WHR 0.90 - 0.99 and 0.80 - 0.84 in males and females respectively and obesity based on WHR  $\geq 1$  in males and 0.85 in females.

Based on BMI, descriptive analysis revealed that 13 (7.6 %) of the study population was underweight, 138 (80 %) had normal weight, 18 (10.5 %) were overweight, while 2 (1.2 %) obese. Table 4 also shows that based on WHR and WC measurements more females than males were overweight and obese. Four (2.3 %) of the subjects (two males and two females) had blood pressure levels indicative of hypertension. Their relationship with FBG, WHR, WC, BMI, sex and age is shown in Table 5.

All the four subjects with high BP measurements had normal WHR. One female had a WC measurement (85 cm) which indicated a high intra abdominal fat mass suggestive of increased risk of chronic diseases of lifestyle. Based on BMI, both females were overweight and one of them had a high FBG of 221 mg/dl. Also among these four subjects there was a positive correlation between age and FBG ( $r = 0.4543$ ,  $p < 0.0001$ ).

**Table 3:** Age-adjusted partial correlation among anthropometric measures in undergraduate pharmacy students

Parameter	Weight	BMI	WC	HC	WHR
Weight	-	0.91	0.64	0.62	0.26
Body mass index	<b>0.84</b>	-	0.64	0.56	0.29
Waist circumference	<b>0.63</b>	<b>0.62</b>	-	0.69	0.66
Hip circumference	<b>0.62</b>	<b>0.57</b>	<b>0.88</b>	-	-0.82
Waist/hip ratio	<b>0.32</b>	<b>0.35</b>	<b>0.69</b>	0.21	-

All coefficients significantly different from zero ( $p < 0.05$ ); unshaded = males; shaded (grey) = females

**Table 4:** Prevalence of obesity and overweight by anthropometric measurement of pharmacy students

Gender	BMI		WHR		WC	
	Overweight N (%)	Obese N (%)	Overweight N (%)	Obese N (%)	Overweight N (%)	Obese N (%)
Female (N=91)	8 (8.8)	1 (1.1)	10 (11.1)	3 (3.3)	8 (8.8)	3 (3.3)
Male (N=81)	10 (12.3)	1 (1.2)	4 (4.9)	1 (1.2)	4 (4.9)	-
Total	18 (10.5)	2 (1.2)	14 (8.1)	4 (2.3)	12 (6.9)	3 (1.7)

**Table 5:** Relationship between blood pressure, anthropometric data, sex and age

BP (mmHg)	FBG	WHR	WC	BMI	SEX	AGE
160/98	64	0.8	79	23.0	Male	24
160/93	48	0.77	85	29.6	Female	20
140/100	221	0.65	64.9	29.9	Female	49
160/100	57	0.84	76	20.5	Male	28

BP = blood pressure (mmHg); FBG (mg/dl) = fasting blood glucose; WHR = waist hip ratio; WC = waist circumference; and BMI = body mass index

There was also a strong positive correlation between systolic blood pressure and WC ( $r = 0.89$ ), as well as WHR ( $r = 0.936$ ) but these were not statistically significant  $p > 0.05$ .

## DISCUSSION

Excess body fat is well documented as being a risk factor for numerous chronic conditions such as diabetes, hypertension, hyperlipidaemia and cardiovascular diseases. In 2005, the WHO reported that the prevalence of obesity in Sub-Saharan African countries was in the range of 3.3 % and 18.0 %, and that obesity had become a leading risk factor for diabetes mellitus and cardiovascular diseases in the urban areas of Africa [9].

The present study showed that based on the common anthropometric measures, only a small percentage (11.6 %) of undergraduate students was overweight or obese. This is incongruent with one study in Nigeria [8], but consistent with the few other similar studies in this age bracket in Nigeria [5-7]. Studies of prevalence of overweight and obesity in university students of other countries also reported much higher prevalence rates. Based on BMI, a study of 749 students from the University of Basque country recorded a prevalence of 17.5 % (25 % in males and 13.9 % in females) [11], another study among a sample of 220 students from the Lebanese American

University (in Beirut) reported a prevalence of overweight and obesity of 24 % and 7.2 % respectively [12]. Yet another study of overweight and obesity in relation to cardiovascular disease risk factors among medical students in Crete, Greece [13] showed 39.5 % male and 23.3 % female students had a BMI  $\geq 25.0$  kg/m<sup>2</sup>.

In this study there was no gender difference in prevalence of overweight and obesity using the BMI index, however, WHR and WC revealed that more females were overweight or obese compared to males. This is a sharp contrast to the aforementioned studies [11-13] where males had a higher tendency to overweight and obesity. Our study on the other hand, agrees with studies by Onyechi and Okolo [8] and Monteiro *et al* [14] which showed respectively that there were more obese female (13.1 %) undergraduates than male (8.2 %) and that obesity is prevalent in adult women in developing economies of which Nigeria is one. Similarly, Abubakari *et al*, in their meta analysis of the prevalence and time trends in obesity among adult West African populations noted that obesity in West Africa had doubled over the previous 15 years (114 %) as at 2008 and that women accounted entirely for this increase [15]. Two of the reasons for the high prevalence of obesity in women include the fact that urban African women perceive the obese body type as what the ideal female body should be, another reason is that females who were

nutritional deprived as children have a higher likelihood to be obese compared to men [16].

BMI measures general obesity while WHR and WC measure central obesity. Studies have shown that WHR and WC are better predictors of cardiovascular risk and mortality [17]. In our study, these latter indices appear to be more discriminatory in assessing overweight and obesity between genders in the population studied. It is therefore recommended that WHR and WC be included in the public health screening of obesity in women.

In this study, rate of hypertension was very low; this is comparable to that of a similar study among students in the West Bank which reported an overall rate of 2.2 % [18], but much less than the rate among medical students in Crete (48 % in males and 36.1 % in females) [1] and even among 5 to 16 year old students in west Bengal, India which recorded an age and stature adjusted BP of 8.6 % [19]. Different studies have indicated different anthropometric indices as best predictive of hypertension. In the West Bengal study among Indian girls [19], BMI and WHR were not associated with hypertension however increased WC was strongly associated with hypertension. A comparable study by Chaudhry *et al* [20] reported a strong correlation between obesity as measured by BMI, WHR and WC and pre hypertension among 150 healthy females aged between 18-25 years. Another study found that of all the obesity indices used in adolescent students only BMI and WC were the only significant predictors of hypertension after adjusting for potential confounders [21]. In this study, only four subjects had a high BP ( $\geq 140/90$ ) and one of them also had an overly high FBG reading, thus associations between obesity indices and hypertension and FBS could not be made.

### Limitations of the study

The findings of this study though may not be representative of pharmacy students of all universities in Nigeria, It provides relevant insight, data, and the feasibility of this study on a larger scale. Another limitation of this study is that our sample was made up of students who undergo strict schedule of lectures and practicals and oftentimes have to skip meals and may not eat as much as they ordinarily would, thus the findings may be different from what actually obtains in the general population of young persons of similar age range.

## CONCLUSION

Overall, there was a low prevalence of overweight and obesity as well as hypertension and diabetes among the pharmacy students sampled. Among the overweight, there was no gender difference in prevalence of overweight and obesity using the BMI index. However, WHR and WC revealed that more females compared to males were overweight or obese.

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