



## **Prevalence of Obesity and Its Effect on Blood Pressure Control in Bida, North-Central Nigeria: A Hospital Based Cross-sectional Study**

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### **Authors' contributions**

*This work was carried out in collaboration between all authors. Authors UGA, AA, FG and IOI designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors UGA, MZA, KPE, OEA and IU managed the analyses of the study. Authors AA, FG, OEA, KPE, IU and IOI managed the literature searches. All authors read and approved the final manuscript.*

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### **ABSTRACT**

**Background:** Obesity is one of the commonest cardiovascular risk factor that affects blood pressure control, but there is lack of data regarding the prevalence of overweight and obesity in hypertensives and their relationship. The aim of this study is to determine the prevalence of obesity and its impact on blood pressure control amongst hypertensives in a rural hospital setting in North-Central Nigeria.

**Study Design:** Cross-sectional, hospital-based study.

**Place and Duration of Study:** Cardiology clinic of Federal Medical Centre, Bida, Northcentral Nigeria, between June and October 2013.

**Methodology:** We recruited 414 hypertensives (204 men, 210 women; age range 21-84 years) adults with arterial hypertension. The blood pressure was measured and data on anthropometric

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indices were collected using a questionnaire. The weight and height was measured, used to calculate the body mass index and to classify the participants into obese and nonobese.

**Results:** The mean age of the hypertensives was  $53.09 \pm 12.30$  years. Out of the 414 participants, obesity occurred in 183 (44.2%) of the participants and more in those in the 45-54 years age range. Out of these, 93 (50.82%) had class I obesity, 55 (30.05%) class II obesity and class III obesity was found in 35 (19.13%) of the hypertensives. Blood pressure control was poor in 105 (57.4%) and 82 (35.5%) of hypertensives with and without obesity respectively. The BMI correlated with age  $r=-0.375$   $p=0.000$ , systolic blood pressure  $-0.181$   $p=0.014$  and diastolic blood pressure  $r=0.439$   $p=0.000$ .

**Conclusions:** The prevalence of obesity is high in hypertensive individuals even in a rural hospital setting and blood pressure control is poor in those who are obese. Public health measures aimed at reducing obesity should be incorporated in the overall management of arterial hypertension.

*Keywords: Obesity; body mass index; hypertension; hospital setting; North-Central Nigeria.*

## 1. INTRODUCTION

Obesity and hypertension are major public health problems with significant morbidity and mortality. According to the Framingham Heart Study, both hypertension and obesity are independent risk factors for cardiovascular disease [1,2]. It has been projected that by 2030, 1.12 billion individuals will be obese globally, but analysis suggest that 2 or more billion people worldwide are currently overweight or obese [3]. The global disease burden attributable to high BMI increased from 52 million in 1990 to 94 million disability-adjusted life-years in 2010 [1].

Obesity was previously thought to be a disease of the western countries and that the developing countries still continue to struggle with underweight, malnutrition and infections [4]. Nigeria though, a developing nation is however said to be at a crossroad with double jeopardy; the upsurge of the non-communicable diseases commonly attributed to obesity, hypertension and diabetes and communicable diseases. This has been suggested to be due to urban and rural drift and the epidemiological transition among others [5]. A number of risk factors such as socioeconomic status (income, level of education, gender, and culture), dietary habit and physical activity are known to affect the development of obesity [6-10]. Even though, the relationship between these factors and obesity are not consistent, some of them like physical inactivity, higher income, female gender and high level of education tend to increase its prevalence while male gender, lower level of education decreases.

Body mass index (BMI) is the most universally accepted and easy to use criteria for the assessment of obesity in individuals [2] which has also been found to correlate with body fat

and associated co-morbid conditions such as hypertension [3]. Several epidemiological studies on obesity in other regions of the country used BMI to determine its prevalence [6,11,12]. These studies were conducted in the general population and the association between blood pressure (BP) control and obesity were not investigated. There are no published studies on the prevalence of obesity in hypertensives in our environment. It is presumed that finding of obesity in hypertensives in a rural hospital setting might have considerable effect on BP control and may serve as a reference study for others.

Against this background, we sought to determine the prevalence of obesity in hypertensives in a rural hospital setting and the effects of the various obesity classes on BP control.

## 2. MATERIALS AND METHODS

### 2.1 Study Design and Setting

This cross-sectional study was conducted in Bida, North-Central Nigeria. Bida is one of the local government headquarters in Niger state and is located 83 kms South-West of the capital, Minna. The population of Bida based on 2006 census figures was 178,840 and mainly inhabited by the Nupe's who are mostly farmers, artisans and blacksmith [13]. The hospital is a 200 bedded tertiary health facility that serves as a referral center to all health facilities in Niger State and environs.

### 2.2 Data Collection Tool

We recruited 414 consecutive adults been follow up for systemic hypertension at the cardiology clinic between June and October, 2013 using the convenient sampling technique. Those that were excluded included individuals with thyrotoxicosis

and chronic kidney disease. Data was collected using the semi-structured questionnaire included socio-demographic characteristics like age, sex and history of hypertension. Blood pressure was measured by trained staff according to standard protocol in a sitting position using a standard mercury sphygmomanometer after 5 minutes of rest [14]. The average of three consecutive measurements was used for analysis. The weight (kilograms) and height (meters) were measured with patients in light clothing. The body mass index (BMI) was calculated by dividing weight in kilograms by the height in meters squared ( $\text{kg}/\text{m}^2$ ). Fasting plasma glucose were determined using blood obtained following an overnight (10–12 hours) fast.

### 2.3 Definition of Study Variables

Hypertension was defined as systolic blood pressure (SBP)  $\geq 140$  mmHg and or diastolic blood pressure (DBP)  $\geq 90$  mmHg or documented use of antihypertensive medications [14]. Good BP control was defined as BP of  $< 140/90$  mmHg. Obesity was classified based on the WHO recommendations [15], underweight as BMI  $< 18.5$   $\text{kg}/\text{m}^2$ , normal as BMI between 18.5–24.9  $\text{kg}/\text{m}^2$ , overweight as BMI between 24.9–29.9  $\text{kg}/\text{m}^2$  and BMI  $\geq 30$   $\text{kg}/\text{m}^2$  was taken as being obese. Grade I obesity (mild obesity) = BMI of 30–34.9  $\text{kg}/\text{m}^2$ , grade II obesity (moderate obesity) = BMI of 35–39.9  $\text{kg}/\text{m}^2$  while grade III obesity (severe obesity) = BMI of  $\geq 40$   $\text{kg}/\text{m}^2$ . Diagnosis of diabetes mellitus was based on venous plasma glucose of  $\geq 7.0$  mmol/l (126 mg/dL).

### 2.4 Data Processing and Analysis

Data were analyzed using SPSS Statistics software for Windows, version 16.0 (SPSS Inc, Chicago, IL, USA). Normally distributed numerical variables were reported as mean  $\pm$  SD and or compared using the independent Student's *t* test. Non categorical variables were expressed as proportions or by chi-square tests. Spearman's correlation was used to determine the effect of grades of obesity on BP control. All *p* values are two-sided and values less than 0.05 were considered significant.

### 2.5 Ethical Considerations

Ethical clearance was obtained from the Ethical review committee of Federal Medical Centre, Bida. The participants enrolled in the study were informed about the study objectives, expected

outcomes, benefits and the associated risks. Confidentiality was maintained throughout the study.

### 2.6 Study Limitations

Some limitations apply to our study and should be noted. The current study is a cross-sectional one; therefore, causation cannot be determined for any of the observed relationships. The lack of detail data on the treatment modalities and regimen precludes the evaluation of the link between BP changes and their appropriateness. The socio-economic factors that are known to affect the prevalence of obesity which might give further insight into the relationship between obesity, hypertension and BP control were excluded and should be considered in subsequent and larger studies.

## 3. RESULTS

The main baseline clinical and demographic characteristics of the 414 hypertensives included in the analysis are described in Table 1. The hypertensives were divided into two; obese (183) and nonobese (231). The mean age of obese hypertensives is  $51.13 \pm 11.64$  years and  $54.58 \pm 12.46$  years for the nonobese hypertensive and differed significantly *p* value = 0.004. The mean BMI of the obese hypertensives was  $35.65 \pm 4.70$   $\text{kg}/\text{m}^2$  and that of the nonobese hypertensives was  $24.12 \pm 3.18$   $\text{kg}/\text{m}^2$ , *p* value = 0.000. They also differed significantly in their SBP ( $149.42 \pm 25.80$  mmHg versus  $138.29 \pm 19.18$  mmHg) and DBP ( $92.30 \pm 15.21$  mmHg versus  $83.72 \pm 15.46$  mmHg) *p* value = 0.000. The fasting blood glucose also differed between obese and nonobese hypertensives.

Table 2 shows the prevalence of obesity in hypertensives using BMI according to age group. The overall prevalence of obesity in hypertensives was 44.2% made up of 88 males (48.1%) and 95 females (51.9%). Obesity was commoner among hypertensives in the age range 45 to 54 years followed by those in the 55 to 64 years age range. There were 93 (50.12%) hypertensives with class I obesity, 55 (30.05%) of them had class II obesity and class III obesity was found in 35 (19.13%) of the hypertensives. Only 10 of the hypertensives less than 35 years and more than or equal to 65 years were obese. The prevalence of overweight in the hypertensives was 40.69%. Those with normal

weight constituted 55.84% and only 3.46% were underweight.

Fig. 1 shows the effects of obesity on blood pressure control among the hypertensives. The BP control in all hypertensives was good in 56% and 44% had poor BP control. Out of those with poor BP control, 70% (130) were either

overweight or obese. The BMI correlated negatively with age  $r=-0.388$   $p=0.000$ , SBP  $r = 0.154$   $p=0.037$  and DBP  $r=0.456$   $p= 0.000$  in obese hypertensives, while in nonobese hypertensives, BMI correlated negatively with SBP  $r = -0.155$   $p=0.018$  and DBP  $r=-0.139$   $p= 0.034$ . However, neither the weight nor the height correlated with the SBP and DBP.

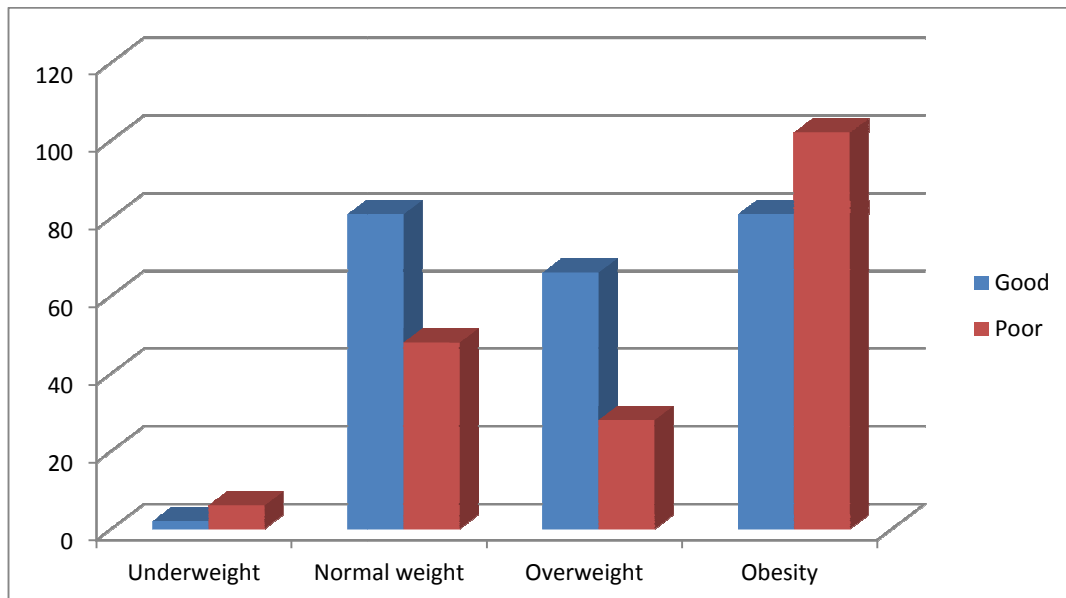
**Table 1. Clinical and demographic characteristics of the hypertensives**

	All (n=414)	Obese (n=183)	Nonobese (n=231)	P
Mean age (years)	53.05±12.21	51.13±11.64	54.58±12.46	0.004
Sex Male/Female	204/210 (49.3/50.7)	88/95 (48.1/51.9)	116/115 (50.92/49.8)	0.087
Mean BMI(kg/m <sup>2</sup> )	29.23±6.86	35.65± 4.70	24.12± 3.19	0.000
Fasting blood glucose (mmol/L)	5.31±1.27	5.54 ± 2.07	5.12±1.47	0.022
SBP mmHg	143.21±23.00	149.42± 25.80	138.29±19.18	0.000
DBP mmHg	87.54±16.35	92.30±15.21	83.72±15.46	0.000

Data are shown as mean±SD or percentage. P values refer to comparison of obese and nonobese hypertensives. BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure

**Table 2. Prevalence of obesity in hypertensives according to age group using BMI**

	≤ 34	35-44	45-54	55-64	≥65	X <sup>2</sup>	P
Classification of obesity	n=32	n=68	n=115	n=116	n=83		
Underweight n=8 (1.93%)	0(0)	3(37.5)	4(50)	1(12.50)	0(0)	6.25	0.174
Normal weight n=129 (31.16%)	5(3.9)	20(15.5)	37(28.7)	33(25.6)	34(26.4)	4.27	0.372
Overweight n=94 (22.71%)	8(8.5)	15(16.0)	14(14.9)	28(29.8)	29(30.9)	9.22	0.055
Obesity							
Class I (n=93) =22.46	6(6.5)	3(3.2)	35(37.6)	31(33.3)	18(19.4)	12.86	0.012
Class II (n=55)=13.29	4(7.3)	18(32.7)	12(21.8)	21(38.2)	0(0)	20.43	0.000
Class III (n=35)=8.45	9(25.7)	9(25.7)	13(37.1)	3(8.7)	1(2.9)	23.75	0.000



**Fig. 1. Blood pressure control in hypertensives according to BMI**

#### 4. DISCUSSION

The main finding of this study was that the prevalence of obesity was high among individuals with systemic hypertension even in a rural clinic setting. In addition, more hypertensives with obesity had poor blood pressure control.

The overall prevalence of obesity in hypertensives in this study was 44.2%, with the sex adjusted prevalence of 48.1% and 51.9% among males and females respectively. This prevalence is lower than 78.2% reported by Fadupin et al. [12] among adult hypertensives attending the Lagos state hospital, Nigeria. This discrepancy may be due to the fact that Lagos is an urban city where hypertensives are more likely to live sedentary lifestyles and have access to processed foods that could enhance weight gain. The study by Rahimi et al. [16] in Iranian hypertensives found rather a much lower prevalence of 13.7% which might probably be due to the fact that the mean BMI ( $29.23 \pm 6.96 \text{ kg/m}^2$  vs  $26.12 \text{ kg/m}^2$ ) of our study population was higher than that of the adult male population of the Fars province. The prevalence of obesity in community based studies in Nigeria is between 8.82% and 26.7% [6,11,12], which is about half the prevalence of obesity reported in our study. This might not be unconnected to the fact that hypertensive individuals that are been followed up in clinics are likely to present with multitudes of risk factors including obesity and other components of metabolic syndrome. A recent community based study in Abuja reported a rising trend in the prevalence of obesity and even described it as an epidemic that might in the long run constitute a big burden to the country [17]. This finding underscores the need for screening at presentation of all hypertensives for obesity as well as other co-morbid conditions.

Obesity in our study also showed female preponderance. This finding is concurrent with studies by other workers in hypertensives in hospital setting [12] as well as in the general population [11,18-20] where obesity is consistently reported to be more associated with females. Studies in the developed World also found higher prevalence among women [21,22]. The higher rate of overweight and obesity in our females participants might be due to among other things, the societal perception which encourages fatness in females and viewed it as a sign of being well taken care of by the husband. Obesity was noted to be more in the age range

between 45-54 and 55 to 64 year in our study. The decline in BMI after this age might probably be due to less ingestion of food with resultant loss of body mass and weight.

In our study, the overall BP control was good in 56% of the hypertensives while 44% of them had poor BP control. Out of those hypertensives with poor BP control, about two-third (78%) were obese. The blood pressure control reported in this study is slightly higher than 42.7% that was reported by Isezuo et al. [23] in a specialized health care setting in Northwestern Nigeria and 24.2% by Akpa et al. [24] from Port Harcourt Nigeria and by Al-Shahrani et al. [25] from Aseer region in a hypertensive and diabetics patients. The prevalence rate in our study is however similar to the rate of 57% that was reported by Onwukwe et al. [26] from South Africa. These differences could be explained by differences in sample size and sampling technique. The need therefore for Physicians to screen individuals with systemic hypertension for obesity cannot be overemphasized.

#### 5. CONCLUSION

This study revealed that obesity is prevalent among hypertensives in a rural hospital setting in Northcentral Nigeria and obese hypertensives had poor blood pressure control. Rigorous health education regarding life style and behavioral changes should be integrated in national health policies to reduce weight and blood pressure control.

#### CONSENT

All authors declare that written informed consent was obtained from the patient for publication of this paper.

#### ETHICAL APPROVAL

The study was approved by the Ethics and Research Committee of Federal Medical Centre, Bida.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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