

Full Length Research Paper

The Effects of Obesity on Hypertension: Does Increase in Body Mass Index Equates Persistent and Poor Control of Hypertension in Nigeria?

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Abstract

This association between obesity and hypertension (HTN) has been established and extensively documented in the western world. However, it is yet to be determined if obesity correlates with poor control of HTN in Nigeria. The aim of this study is to find out if obesity is associated with persistent high blood pressure and or there are other associated common risk factors for HTN in Nigeria. This is a cohort study involving 130 patients with HTN. Patients were compliant with medications. The body mass indexes (BMI) of all the patients were determined and compared with their level of blood Pressure and common risk factors for HTN were also evaluated. The CC between obesity and diastolic blood pressure ($r = -0.90$; $CD = 81\%$), systolic blood pressure ($r = -0.66$; $CD = 44\%$) and Mean Arterial Pressure (MAP) ($r = 0.39$; $CD = 15\%$. Male = -0.94 . Female = -0.98). Other risk factors for HTN include family history (90%), occupation (Farmers: 69.2%), Environment (Rural: 72.3%), Alcohol (56.9%), Tobacco (53.8%), dyslipidemia (10.7%), Age (HTN peaks at the 6th decade of life). Obesity doesn't necessarily associate with persistent, poor control of HTN in Nigeria in this study, contrary to Caucasians studies.

Keywords: Hypertension, Obesity, Correlation, co-morbidity, Risk Factors, Nigeria, Caucasians, Cardiovascular.

INTRODUCTION

Hypertension is defined as blood pressure $\geq 140/90$ mmHg (James PA et al., 2014). It is a disease that has placed high financial burden on patients, families as well as Nigeria Health care system. It has been consistent with the global projections of burden of diseases from 1990 -2020. (Lopez AD et al., 1998). The recognized global risk factors for hypertension include family history of hypertension, alcohol intake, salt intake, tobacco smoking, physical inactivity, hyperlipidemia, advancing age and obesity. (Lopez et al., 1998). Oni et al in 2009, reported hypertension, amongst other risk factors was a leading cause of stroke in 89% of patients studied in the south-south region of Nigeria. Akinkugbe

OO is generally regarded as the father and doyen of hypertension research in Nigeria (Akinkugbe et al., 1968a and b; 1969a and b; 1977). He documented that: (1) Systolic blood pressure rose with age in both sexes and in all age groups from 12-70 years. This trend was less marked in diastolic blood pressure; (2) Blood pressure levels were similar in women from rural and urban areas but seemed much higher in urban than in rural men; (3) The rate of rise of pressure was more rapid in earlier decades than subsequently; (4) There was little correlation with weight and much less so with height after 40 years of age;

Obesity is a major risk factor for a number of chronic diseases, including diabetes, cardiovascular diseases, osteoarthritis, asthma and cancer. (Lopez et al., 1998). Once considered a problem only in high income countries, Obesity is dramatically on the rise in low and middle income countries, particularly in urban settings.

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(Lopez et al., 1998; ChulLee et al., 2010). It is the fifth leading risk for global deaths. (ChulLee et al., 2010). BMI measurement is used as an alternative to the measurement of adipose tissue mass in the evaluation of obesity. In addition, World Health Organization (WHO) has proposed BMI as the most useful epidemiological measure of obesity in population studies. (WHO Technical report series 854, 1995, 2000, 2004).

The association between hypertension and obesity has been demonstrated by large population based studies. (Timpson et al., 2009; Garrison et al., 1987). It has been reported amongst African –Americans, Chinese and African studies. (Garrison et al., 1987; He et al., 1994; Bell et al., 2002). Tesfaye et al. 2007, described a J-shaped relationship between BMI and blood pressures. In addition, some researchers have described a minimum threshold required for Body mass index (BMI) to be positively associated with blood pressure. (Dyer and Elliot, 1989). The exact explanation of this relationship is still not clear as no biological model of this association has been established. However, a number of metabolic consequences of obesity have been proposed as the blood pressure elevating mechanisms. These include fluid and salt retention, Insulin resistance, and production of angiotensinogen by adipose tissue. (Narkiewicz, 2006; Wiecek, 2002). The relationship between blood pressure and body mass index has been further substantiated by the effect of weight reduction on blood pressure. (Narkiewicz, 2006; Wiecek, 2002; Wofford and Hall, 2004).

In the management of hypertension, It is not known if obesity and other risk factors that will significantly increase the risk of cardiovascular complications are taken into consideration. However, the total cardiovascular risk factors are more important than the level of blood pressure as a guide to aggressiveness or intensity of the intervention. The importance of weight reduction in the management of hypertension is less well documented and there are limited published information on the relationship between obesity and increased high blood Pressure in Nigeria. The aim of this study is to find out if obesity is associated with persistent high blood pressure and or there are other associated common risk factors for HTN in Nigeria.

METHOD AND METHODOLOGY

The Clinical setting was the Medical Clinic of the Niger delta University Teaching Hospital, Okolobiri, Bayelsa state. This is a cohort study involving 130 subjects that were selected using a simple sampling method in the medical clinic, over a period of one year. Patients were strictly followed for effective drug adherence. Exclusion criteria were: (1) Non compliance (2) Unconscious Patients (3) Refusal for personal reasons etc. All hypertension patients that gave consents and have been regular on medications were included in the study. The

JNC V111 definition of hypertension was used in this study ($\geq 140/90$ mmHg). The average of three blood pressure measurements taking at different occasions was recorded for each subject. The blood pressures were taken early in the morning prior to ingestion of any medication. Obesity was represented with body mass index, calculated as weight in Kg divided by height in meters squared. It was graded using the world health organization data base criteria: (underweight= < 18.5 , Normal = $18.5 - 24.9$, Overweight/obese = ≥ 25). The various parameters were expressed as means and the cardiovascular risk factors were expressed as percentages. We correlated obesity (body mass index) with the mean arterial, systolic and diastolic blood pressures using the Karl Pearson Formulae.

RESULT

Table 1 reveals the mean age of patients (59years), mean arterial Pressure, systolic and diastolic blood pressure (SBP and DBP). Also, the mean BMI for women is slightly higher than the values for men. Rural (R) dwellers have a higher prevalence of hypertension than urban (UR) dwellers in this study. The associated hypertensive risk factors include Family history (90%), occupation (Farmers=69.2%), Environment: Rural(R) = 72.3%, alcohol consumption (56.9%), tobacco smoking (53.8%), Raised Lipid level (10.7%) and Age (Hypertension peaks at the 6th decade of life). Table 2 shows that blood pressure increases with age and peaks in the 6th decade of life after which it starts declining. More female had high blood Pressure from the third to the fifth decade of life while it equals at the sixth decade and subsequently higher in male than female. MAP increases with BMI up to a mean of 22.4 Kg^{-2} but declined subsequently. There is a reverse order relationship between BMI and SBP/DBP in table 3. Table 4 shows a negative correlation coefficient between BMI and DBP ($r = -0.90$); SBP ($r = -0.66$); MAP for both sex independently $r = -0.94$ in men, $r = -0.98$ in women and combined $r = 0.39$.

DISCUSSION AND CONCLUSION

Hypertension is a public health challenge because of its high frequency and concomitant risk of cardiovascular and renal diseases. It has been estimated that the worldwide prevalence of hypertension was 972 million in 2000, and this number will increase by 60% by the year 2025. (Kearney et al., 2005).

Few studies have examined the relationship between obesity and hypertension as part of a global cardiovascular risk factors in West Africa. (Cooper et al., 1997; Amole et al., 2011; Puoane et al., 2005; Rguibi et al., 2004). Evidence for a consistent link between obesity or adiposity and hypertension is revealed by the almost

Table 1. Social Demographic Factors of Patients

Items	values
Sex: M/F	70/60
Mean Age	59.5
mean BMI	23.2
BMI (F/M)	24.4/22.
Farmers	90
Civil Servants	40
R/UR	94/36
Mean Blood Pressure	164.8/99.1
MAP (M/F)	121(121.7/120.3)
Family History	90%
Alcohol consumption	56.9%
Smoking	53.8%

Table 2. Sex distribution of subjects

Age Range	Male	Female	Total
38 -50	8	20	28
51 -60	24	28	52
61 -70	22	6	28
≥ 71	16	6	22
Total	70	60	130

Table 3. Mean of the MAP, SBP,DBP, BMI and the number of subjects in each BMI group.

BMI group	Frequency	BMI	MAP	SBP	DBP
<18.5	12	17.4	95.3	176.3	110
18.5 - 24.9	74	22.4	141.7	164	99.08
≥25	44	29.8	118.4	162.9	96.2

Table 4. Correlation Coefficients between BMI,MAP,DBP and SBP

Blood Pressures	Correlation coefficient
Mean arterial Pressure (MAP)	0.39
Systolic Blood Pressure (SBP)	-0.66
Diastolic Blood Pressure (DBP)	-0.90
Mean Arterial Blood Pressure (MAP). Male	-0.94
Mean Arterial Blood Pressure(MAP).Female	-0.98

linear relation between body mass index and SDP/DBP, at least over a body mass index range from 16 to 31 kg/m. (Kaufman et al.,1997; Mufunda et al., 2006). The result of our study revealed a reverse, negative, non linear relationship between obesity and blood pressure (systolic, diastolic and Male /female MAP). However, there was a weak linear relationship between Mean arterial blood pressure (combined male and female patients) and BMI up to an average of

22.4Kg/m² in this study. This was revealed in the positive correlation coefficient between BMI and MAP (0.39). This correlates with the work of Akinkugbe et al. 1968 and 1969, who documented little correlation with weight and much less so with height after 40 years of age.

Our study shows that obesity does not necessarily cause persistent uncontrolled hypertension. Some obese individuals never had corresponding elevated (systolic

and diastolic) blood pressure when compared with some normal BMI subjects who have high blood pressure. Our report collaborates with the work of stevo et al. 2000.

However, other studies show that the magnitude of weight gain is almost invariably associated with an increase risk of developing hypertension (Kotsis et al., 2010; Kotchen et al., 2010; Weng et al., 2006), and that modest weight loss is associated with a reduction in blood pressure in obese. (Kotsis et al., 2010; Kotchen, 2010; Weng et al., 2006).

In addition, analysis of the relationship between blood pressure and BMI that has been disaggregated into underweight, normal BMI and overweight (or obese) has not always yielded a positive association. While some researchers have described a J-shaped relationship between BMI and blood pressures (Tesfaye et al., 2007), others have found a minimum threshold required for BMI to be positively associated with blood pressure. (Kaufman et al., 1997). Meanwhile, these studies have not elucidated the appropriate threshold below which blood pressure is associated with low BMI. Risk estimates from the Framingham Heart Study suggest that approximately 78% of the hypertension cases in men and 65% in women can be directly attributed to obesity. (Garrison et al., 1987) However, our study did not elucidate the percentage of hypertension cases in both sex caused by obesity. This remains a topic for future studies.

Furthermore, obesity may be an important risk factor for hypertension but not all obese subjects in the society have hypertension. Therefore, obesity is not a major risk factor for hypertension in Nigeria. Other hypertensive/cardiovascular risk factors revealed in this study were family history, age, alcohol, Tobacco smoking, hyperlipidaemia, rural dwelling, occupation (farmers > civil servants). The peak of hypertension in the 6th decade is of importance in this environment as more hypertensive patients are prone to cardiovascular complications. This corresponds with the report of Oni et al. 2009, who demonstrated a higher incidence of hypertensive stroke at the 6th decade of life in Nigeria. Ineffective medication and non adherence to medications are causes of persistent, poor control of hypertension (Brown and Bussell, 2011; Chobanian, 2009; Amira and Okubadejo, 2007). However, ineffective medication or non adherence to anti-hypertensive medications wasn't a subject of our study because our subjects were strictly compliant with therapy. In conclusion, obesity is not a major risk factor for the development of hypertension in this study.

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