Blood pressure pattern and body composition of hypertensive outpatients attending University college hospital, Ibadan.

Oluwasiji Olabisi O[1*], Adebiyi Adewole A[2], Fadupin Grace T[3]

[1]Department of Food Science and Technology, Wesley University, Ondo, Nigeria

[2]Cardiology Clinic, University College Hospital, Ibadan, Nigeria

[3]Department of Human Nutrition, University of Ibadan, Ibadan, Nigeria

Abstract

Hypertension is one of the chronic non-communicable diseases which pose public health challenges in developing countries especially among black race, and excess weight gain has been found to be one of the predictors of hypertension. Conventional Body Mass Index (BMI) is limited in measuring the weight gain in individuals of all population groups and this gives the need for more reliable anthropometric index such as waist circumference, waist-to-hip ratio and waist-to-height ratio to measure body composition.

This study evaluates the relationship between blood pressure pattern and body composition of the hypertensive outpatients who were attending University College Hospital, Ibadan, and Oyo State, Nigeria.

The study design was descriptive cross-sectional involving ninety-two (92) hypertensive outpatients; 55 females and 37 males. A semi-structured, interviewer-administered questionnaire was used to interview the participants. The past three and the current participants' Blood Pressure (BP) readings were assessed from their case files after the patients had consulted the physicians, and average BP was calculated for each patient.

Weight (kg), body fat and visceral fat of the participants were measured by Automated Omron device. Height (m) measured with the use of stadiometer. Waist circumference (m) and Hip circumference (m) were measured with non-stretchable tape. Waist-to-height, waist-to-hip ratio and Body Mass Index were calculated.

The hypertensive outpatients were 40.2% males and 59.8% females. Mean age of the male and female participants were 57.1 ± 13 years and 54.8 ± 13 years respectively. More than half (53.3%) of them had family history of hypertension (HTN) and some (41.4%) of them had been treating hypertension for five years while 49.5% had been on treatment for more than five years. Of all the patients, only 6.5% had normal BP, 44.6% had preHTN, 31.5% had stage 1 HTN and 17.4% had stage 2 HTN.

Mean weight of the female and male patients were 73.45 ± 12.46 kg and 74.98 ± 12.52 kg respectively. Mean height of the female and male patients were 1.61 ± 0.06 m and 1.73 ± 0.09 m respectively. Waist circumferences of the female and male patients were 0.95 ± 0.16 m and 0.94 ± 0.10 m respectively.

Waist-to-Hip Ratios (WHR) of the female and male patients were 0.96 ± 0.14 and 0.94 ± 0.10 respectively. Waist-to-Height Ratios (WHtR) of the female and male patients were 0.59 ± 0.09 and 0.54 ± 0.06 respectively. Body fat parentages of the female and male patients were 39.57 ± 7.51 and 22.53 ± 8.39 respectively.

Visceral fat percentages of the female and male patient were 9.05 ± 3.05 and 9.65 ± 5.08 respectively. Resting Metabolism of the female and male patients were 1436.33 ± 143.65 and 1606.43 ± 187.97. Significant associations were observed between the age and diastolic blood pressure (p=0.001), between the weight-to-height ratio and systolic blood pressure (p=0.019) and diastolic blood pressure (p=0.032) of the patients; between body muscle of the patients and diastolic blood pressure (p=0.055).

In conclusion, majority of the hypertensive outpatients had family history of hypertension. There was prevalence of prehypertension and stage 1 hypertension among the patients. Most of them were overweight, obese and had high abdominal adiposity which predicts risk of metabolic diseases such as diabetes and hyperlipidemia among the hypertensive patients.

Significant relationship was found between waist-to-height ratio and systolic and diastolic blood pressures, and between age and diastolic blood pressure, and between body muscle and diastolic blood pressure.

Keywords: Blood pressure, Body composition, Hypertension, Outpatients.

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Introduction

Hypertension is one of the chronic non-communicable diseases which pose public health challenges in developing countries especially among the black race where it is more prevalent with early onset and clinically more severe [1]. It is an established risk factor of cardiovascular disease, premature death and devastating condition related to the cerebrovascular, cardiovascular and renal complications [2,3].

As people increase in age, adults tend to be more physically inactive and store fats in their bodies, which slow down metabolism leading to the secretion of chemicals such as cortisol, leptin and other hormones which are more likely to cause obesity [4].

Excessive calorie intake, genetics, culture and lifestyle are other predictors of increased body fat. Excess weight gain has been found to be one of the predictors of hypertension and body fat distribution predicts hypertension independently of Body Mass Index [5,6].

Body composition is the relative amount of fat and fat free mass of the body. Conventional Body Mass Index (BMI) is limited in measuring the obesity and overweight in individuals of all population group because it does not distinguish between the lean muscle and fat mass and does not account for important contributors to weight such as bone density and blood volume [7]. Body Mass Index does not account for ethnic difference in body composition and distribution of excess fat [8].

Body composition of individuals is measured mostly by the anthropometry indicators which predict the adiposity, lean body mass and size [6]. This explains the reason for using other anthropometric parameters such as waist circumference, waist-to-hip ratio and waist-to-height ratio [9,10] in addition to BMI to determine the body adiposity.

The study aimed to determine pattern of blood pressure and its association to the body composition among the hypertensive outpatients who attended Cardiology unit at University College Hospital, Ibadan.

Materials and Methods

This study was descriptive cross-sectional in design, carried out among the ninety-two (92) hypertensive outpatients comprising of 55 females and 37 males who attended Cardiology Clinic of Medical Outpatients in University College Hospital, Ibadan, Oyo State, Nigeria. The University College Hospital, (UCH) Ibadan is the premier tertiary hospital and a reference health center for healthcare delivery in Nigeria.

A semi-structured, interviewer-administered questionnaire was used to interview the participants. The past three and the current participants' Blood Pressure (BP) readings were assessed from their case files after the patients had consulted the physician, and average BP was calculated for each patient.

Weight (kg), body fat and visceral fat of the participants were measured by Automated Omron device. Height (m) measured with the use of stadiometer. Waist circumference (m) and Hip circumference (m) were measured with non-stretchable tape. Waist-to-height, waist-to-hip ratio and Body Mass Index were calculated.

Blood pressure of the participants was classified into normal BP, prehypertension, Stage 1 hypertension and Stage 2 hypertension according to the recommendation of the United States Joint National Committee on Prevention, Detection, Evaluation and Treatment of high blood pressure.

The classification of blood pressure control was based on the European Society of Hypertension and the European Society of Cardiology classification (ESH/ESC, 2013). The controlled blood pressure was placed with systolic blood pressure reading of less than 140 mmHg and diastolic blood pressure readings of less than 90 mmHg [11].

The ethical approval for the study was obtained from the Institutional Review Board, Institute of Advanced Medical Research and Training (IAMRAT), University College Hospital (UCH), the University of Ibadan, Ibadan.

Overweight and obesity were defined by multiple definitions depending on the diagnostic tool employed, viz: (1) BMI>25 but <30 (overweight) and BMI ≥ 30 (obese) (WHO, 1998), (2) WC>84 for women and >102 for men, WHR ≥ 0.90 for men and ≥ 0.85 [12], (3) WHtR ≥ 0.5 and (4) percentage body fat ≥ 32.0% (overweight) and ≥ 37.1% (obese) in black females and ≥ 21.7% (overweight) and ≥ 28.3%(5) (obese) in black males [13]. Visceral fat is considered as normal (1-9), high (10-14) or very high (15-30) [14].

Data collected were analyzed with the use of Statistical Package for Social Science (SPSS) software, version 20.0. Data were expressed as mean, standard deviation, frequency and percentage. Chi square test was used to determine association between variables and the gender while logistic regression was determined to test the association between the nutritional status, body composition, systolic blood pressure and diastolic blood pressure. Level of significance was $p<0.05$.

Results

The study comprised of 40.2% male and 59.8% female hypertensive outpatients who had mean age of 57 ± 13.26 years and 55 ± 13.39 years respectively. More than half (50.2%) of the participants were aged 55 years and above. Large numbers (85.9%) of them were married. Seventy-six percent of the participants were either traders or retirees.

Statistical significance (p=0.017) was observed in the occupational status of the participants (Table 1).

Table 1: Socio-demographic status of the Patients.

Characteristics	Male (n=37) n (%)	Female (n=55) n (%)	Total (n=92) n (%)	X^2	P value
Age (years)					
Mean (SD)	57.1 (13.26)	54.8 (13.39)	55.7 (13.32)	1.433	0.698
Range	23-79	21-82	21-82		
21-37	2 (25.0)	6 (75.0)	8 (8.7)		
38-54	12 (37.5)	20 (62.5)	32 (34.8)		
55-71	17 (42.5)	23 (57.5)	40 (43.5)		
≥ 72	6 (50.0)	6 (50.0)	12 (13.0)		
Marital Status					
Single	2 (5.4)	2 (3.6)	4 (4.3)	3.724	0.293
Married	34 (91.9)	45 (81.9)	79 (85.9)		
Divorce/Separated	0 (0.0)	2 (3.6)	2 (2.2)		
Widowed	1 (2.7)	6 (10.9)	7 (7.6)		
Occupational Status					
Artisan	1 (2.7)	3 (5.5)	4 (4.3)	10.248	0.017*
Trader	7 (18.9)	28 (50.9)	35 (38.0)		
Civil servant	9 (24.3)	9 (16.4)	18 (19.6)		
Retiree	20 (54.1)	15 (27.2)	35 (38.1)		
Note: *P<0.05, SD- Standard Deviation.					

Information on the medical history of the patients is presented by Table 2. It was observed that more than half (53.3%) of the participants had family history of hypertension and some (41.4%) of them had been treating hypertension for five years while 49.5% of them had been treating it more than five years.

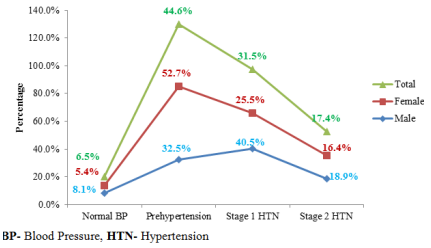
Table 2: Medical History of the Patients.

Health information	Male (n=37) n (%)	Female (n=55) n (%)	Total (n=92) n (%)	X2	P value
Family History of hypertension					
Yes	17 (34.7)	32 (65.3)	49 (53.3)	1.33	0.249
No	20 (46.5)	23 (53.5)	43 (46.7)		
Year of Diagnosis					
<1year	5 (62.5)	3 (37.5)	8 (8.8)	9.43	0.093
1-5years	14 (36.8)	24 (63.2)	38 (41.4)		
6-10years	7 (25.9)	20 (74.1)	27 (29.4)		
11-15years	1 (25.0)	3 (75.0)	4 (4.4)		
16-20years	4 (80.0)	1 (20.0)	5 (4.5)		
>20years	6 (60.0)	4 (40.0)	10 (11.2)		

Presence of other ailment(s) with Hypertension					
Yes	19 (52.8)	17 (47.2)	36 (39.1)	3.881	0.049*
No	18 (33.1)	38 (67.9)	56 (60.9)		
Patients' Purpose of taking Medication					
For Hypertension only	22 (33.3)	44 (66.7)	66 (71.7)	5.377	0.068
For Hypertension and other ailments	14 (56.0)	11 (44.0)	25 (27.2)		
Not taking medication	1 (100.0)	0 (0.0)	1 (1.1)		
Patients' BP Control level					
≤ 140/90 mmHg	15 (31.9)	32 (68.1)	47 (51.1)	2.755	0.097
≥ 140/90 mmHg	22 (48.9)	23 (51.1)	45 (48.9)		
Note: *p<0.05.					

Table 2 presents the medical history of the participants. It was observed that large number (60.9%) of the patients had only hypertension while 39.1% of them had additional ailments to hypertension.

Such ailments were; kidney diseases (13.0%), diabetes (7.6%), heart diseases (2.2%), Respiratory disease (2.2%), and other diseased conditions (such as arthritis, cancer, eye defect, goitre, ascities, oedema, pile, hepatitis, GIT problem) accounts for 14.1% (Table 3). A statistical significance (p=0.049) was observed between the patients who had only hypertension and the patients who had hypertension with other diseases (Table 2). On medication, 71.7% of the patients took medications prescribed by the physicians for high blood pressure only while 27.2% of the patients took the medications for both hypertension and other diseases and very few (1.1%) did not take medication as at the time of the study.



BP- Blood Pressure, HTN- Hypertension

Figure 1: *Pattern of Blood Pressure among the Hypertensive Patients.*

The blood pressure pattern of the patients is presented by Figure 1. Only 6.5% (male=8.1%, female5.4%) of the patients had normal blood pressure; 44.6% (male= 32.5%, female=52.7%) had prehypertension, 31.5% of the patients (male=18.9%, female=25.5%) had stage 1 hypertension and 17.4% (male=18.9%, female=16.4%) had stage 2 hypertension. Half (51.2%) of the patients had their blood pressure controlled while 48.9% of the patients had their blood pressure uncontrolled (Table 3).

Table 4 shows the Body Mass Index (BMI) of the participants. It was found that many (64.1%) of the patients were either overweight (36.8%) or obese (27.2%).

Table 3: *Other Health conditions with Hypertension among Hypertensive Patients.*

Other health conditions with Hypertension	Frequency	Percentage
Kidney disease	12	13
Diabetes	7	7.6
Heart disease	2	2.2
Respiratory disease	2	2.2
Others (athritis, cancer, eye defect, goitre, ascities, oedema, pile, hepatitis, GIT problem)	13	14.1
Without other ailment(s)	56	60.9

Overweight (64.7%) and obesity (80.0%) were higher among the female patients than among the male counterparts. The Body Mass Index (BMI) of the patients was statistically significant across the gender (p=0.006).

Table 4: *Body Mass Index of the Patients.*

Body Mass Index (BMI) (Kg/m^2)	Male (n=37) n (%)	Female (n=55) n (%)	Total (n=92) n (%)	X^2	P value
18.5-24.99	20 (60.6)	13 (39.4)	33 (35.9)	10.299	0.006*
25.0-29.99	12 (35.3)	22 (64.7)	34 (36.9)		
≥ 30.0	5 (20.0)	20 (80.0)	25 (27.2)		
Note: *p<0.05.					

Table 5 presents the relationship between anthropometry index and the blood pressure of the hypertensive patients. The mean weights of the female and male patients were 73.45 ± 12.46 kg and 74.98 ± 12.52 kg respectively. The mean height of females

was 1.61 ± 0.06 m and that of male patients was 1.73 ± 0.09 m. Waist circumferences of the female and male patients were 0.95 ± 0.16 m and 0.94 ± 0.10 m respectively.

Waist-to-Hip Ratios (WHR) of the female and male patients were 0.96 ± 0.14 m and 0.94 ± 0.10 m respectively. Waist-to-height ratios (WHtR) of the female and male patients were 0.59 ± 0.09 m and 0.54 ± 0.06 m respectively. Body fats (%) of the female and male patients were 39.57 ± 7.51 and 22.53 ± 8.39 respectively.

Visceral fat (%) of the female and male patients were 9.05 ± 3.05 and 9.65 ± 5.08 respectively. Resting Metabolisms of the female and male patients were 1436.33 ± 143.65 and 1606.43 ± 187.97. Significant associations were observed between the age and diastolic blood pressure (p=0.001), between the waist-to-height ratio and systolic blood pressure (p=0.019); waist-to-height ratio and diastolic blood pressure (p=0.032) of the patients. Body muscle of the patients had significant association with the diastolic blood pressure (p=0.055).

Table 5: Relationship between Anthropometric Index and Blood Pressure of the Hypertensive Patients.

Index	Mean	St. Dev	Max	Min	Systolic BP P value	Diastolic BP P value
Age						
Female	54.76	13.39	82	21	0.976	0.001*
Male	57.11	13.26	79	23		
Weight (kg)						
Female	73.45	12.46	106.3	50.1	0.273	0.496
Male	74.98	12.52	101.1	50.7		
Height (m)						
Female	1.61	0.06	1.75	1.46	0.373	0.735
Male	1.73	0.09	1.92	1.53		
BMI (kg/m^2)						
Female	28.17	4.39	35.8	20.1	0.244	0.765
Male	25.09	3.93	34.5	18.6		
WC (m)						
Female	0.95	0.16	1.37	0.42	0.173	0.22
Male	0.94	0.1	1.11	0.74		
WHR						
Female	0.96	0.14	1.37	0.42	0.239	0.599
Male	0.94	0.1	1.11	0.74		
WHtR						
Female	0.59	0.09	0.78	0.25	0.019*	0.032*
Male	0.54	0.06	0.65	0.44		
Body Fat (%)						
Female	39.57	7.51	50.7	19.7	0.596	0.165
Male	22.53	8.39	39.5	6.5		
Visceral fat (%)						
Female	9.05	3.05	18	2	0.303	0.094
Male	9.65	5.08	22	2		
Body Muscle						
Female	26.01	4.79	51.7	19.2	0.244	0.055*
Male	33.94	5.18	46.1	22.5		

RM						
Female	1436.33	143.65	1835	1162	0.892	0.463
Male	1606.43	187.97	1974	1141		
SBP						
Female	139.24	15.37	115	177	-	-
Male	144.41	15.76	115	176		
Diastolic BP						
Female	84.42	9.901	65	117	-	-
Male	88.08	8.64	70	105		

Note: *p<0.05, WHR- Waist-to-hip ratio, WHtR- Waist-to-height ratio, WC-Waist Circumference, RM- Resting Metabolism, SBP- Systolic Blood Pressure, DBP-Diastolic Blood Pressure

Discussion

Treatment of the modifiable risk factors of hypertension such as dyslipidemia, abdominal obesity and diabetes is the primary goal of hypertensive patients in order to reduce the long-term risk of cardiovascular morbidity and mortality [15-17]. The age of most (78.3%) of the hypertensive patients in this study was within 38 to71 years, showing that both young adults and older adults are suffering from high blood pressure. This supports the results of the studies conducted by other researchers [13,17,18].

This study found significant association between Diastolic Blood Pressure (DBP) and age among the hypertensive outpatients. It supports the findings in which it was reported rise in diastolic blood pressure with increased age among the Pakistan adults in the comparative study conducted among three populations at Metrovill [19]. Tziomalos et al. observed that the relationship between DBP at admission and outcome appears to be more prominent in hypertensive patients and higher DBP at admission predict in-hospital mortality in patients with acute ischemic stroke. This shows the relative effects of increased diastolic blood pressure among the hypertensive patients [20].

Having more than half of the hypertensive patients in this study with family history of hypertension, reveals that hypertension is a hereditary disease which has been confirmed by many studies in Nigeria and abroad [20-22]. However, this is in contrast to the finding of Deji et al. [16] who reported that family history was not a risk factor of hypertension among the Yoruba adults in the similar study location, South-West, Nigeria where our study was conducted.

It was observed in this study that about half of the hypertensive patients in Nigeria had been visiting hospital for treatment more than five years. The number of these patients (49.5%) is greater than 25.8% reported by Deji et al. [16]. The increase can be due to poor adherence of the hypertensive patients to their medication or the patients engaging in lifestyles which prevent adequate blood pressure control among the hypertensive patients. It could also reveal the state of the health system in Nigeria. Although, the level of blood pressure control in this study shows that half of the patients had their blood pressure controlled (≤ 140/90 mmHg), but it was evident that majority of the hypertensive outpatients who participated were having prehypertension and stage 1 hypertension [23].

The prevalence of prehypertension (44.6%) observed in this study was closed to the level (45.5%) reported by Chimezie et al. in their cross-sectional study among adults in Umuahia, South-East Nigeria; less than 58.7% prevalence observed by Isezuo in Northern Nigeria and more than 37.2% reported by Mengistu in Ethiopia; 32.3% reported by Hu L [5] in China and 26.1% reported by Gyamfi et al. in Ghana [21]. Prehypertension has been reported to be the risk factor of hypertension, cardiovascular mortality and morbidity, a 3.5-fold increase in myocardial infarction, atherosclerosis, small vascular damage, coronary artery calcification, vascular remodeling, and left ventricular hypertrophy [24-27]. Prehypertension has been found to be strongly linked with the family history of hypertension, dietary pattern, lack of exercise, abdominal adiposity and markers of genetic pre-disposition to high blood pressure including parental hypertension or diabetes [12,28].

On the body composition of the hypertensive patients, many of the patients who participated in this study had increased waist-to-height ratio, waist circumference, waist-to-hip ratio, Body Mass Index, body fat and visceral fat more than the normal recommendations for both male and female adults. This study observed that many of the patients were overweight and had abdominal adiposity. The association of abdominal adiposity with cardiovascular and metabolic diseases such as Type 2 diabetes and hypertension had been observed by many studies [29]. The excess weight and body fat observed among the hypertensive patients can be due to the sedentary lifestyle which many retirees and traders were known [15]. They tend to sit down for long period of time without expending the calorie consumed.

This study found significant association of systolic and diastolic blood pressures with waist-to-height ratio and body muscle. This is in agreement with the findings of Roberta et al. who reported linear correlation between waist-to-height ratio and blood pressure in their study which was conducted among the factory male workers in São Paulo State, Brazil. Alena also

observed association between waist-height ratio and systolic blood pressure in his cross sectional study conducted among the migrants of Russian and Kurdish women in Finland [30]. Waist-to-height ratio has been found to be more sensitive to predict metabolic risk than BMI and to allow similar boundary value for different ethnic groups. It has been found to be the best anthropometric predictor of hypertension [31].

Conclusion

This study establishes that majority of the hypertensive outpatients had family history of hypertension. There is prevalence of prehypertension and stage 1 hypertension among the patients. Most of the patients were overweight, obese and had high abdominal adiposity which predicts risk of metabolic diseases such as diabetes and hyperlipidemia among the hypertensive patients. Significant relationship was found between waist-to-height ratio and systolic and diastolic blood pressures, and between age and diastolic blood pressure, and between body muscle and diastolic blood pressure.

Limitation of this Study

The cross-sectional design of this study affects its causal inference. This study was unable to assess the lifestyles (such as, dietary intake, smoking, alcohol consumption, physical activity and stress) of the hypertensive patients which could predict the cause of excess weight gain and abdominal adiposity which anthropometry measured. Further study is needed to measure the lifestyles and biochemical parameters (such as lipid profile and blood sugar) of the patients should be measured to determine the risk factors of hypertension and their relationship with prehypertension.

Recommendation

Hypertensive outpatients are advised to seek medical advice on how to lose weight, see the dietitian for appropriate diet regimen for their health condition, engage in appropriate physical exercise, avoid intake of saturated fat and psychological stress which could predispose them to adiposity.

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*Correspondence to

Dr. Olaitan Oluwasiji Olabisi

Department of Food Science and Technology

Wesley University

Ondo, Nigeria

Email: sijola2k3@gmail.com