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Research Article

Relationship between Body Mass Index and Hypertension among Police Officers in Port Harcourt

Ajah AA, Amah-Taria FS* and Iwu IC
Department of Human Physiology, University of Port-Harcourt, Nigeria

***Corresponding author:** Amah-Taria FS, Department of Human Physiology, Faculty of Basic Medical Sciences, College of Health Sciences, University of Port-Harcourt. Rivers State, Nigeria

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Abstract

Amidst the ravaging burden of obesity and hypertension in developing countries, there is limited information on the contribution of Body Mass Index (BMI) to Blood Pressure (BP). This study investigates the relationship between BMI and hypertension among police officers in Port Harcourt. A total of 245 police subjects between the ages of 21-60 years were used for the study. The subjects were divided into three major groups; Administrative, Traffic and Mobile police officers. Their mean blood pressure (systolic and diastolic) was measured and their BMI, calculated as weight (kg) divided height (m2). The result showed the BMI of the males increased with age in contrast to the females that was independent of age as shown by the z-test of the means BMI of the sample police men and police women. Also, hypertension was prevalent among the major groups, with the prevalence of hypertension higher among obese officers (22.90%) in comparison with non-obese hypertensive (17.55%) and non-hypertensive obese (15.90%) in both male and female police. The result from the study also showed the correlation between systolic blood pressure – obesity and diastolic blood pressure -obesity for hypertensive and obese police subjects were (-0.738 and 0.403; -0.3.69 and 0.312) respectively. This shows there was a significant relationship between hypertension and obesity.

Keywords: Body mass index; Obesity; Hypertension; Blood pressure

Introduction

High blood pressure (hypertension) is a blood pressure disorder characterized by a persistent increase in both systolic (pressure>140mmHg) and diastolic (pressure>90mmHg) pressures respectively. Reports have it that, high Blood Pressure (BP) is estimated to cause 7.1 million deaths, about 13% of the total globally [1]. Research reports emphasize that overweight and obesity increases the risk of high BP, coronary heart disease, ischemic stroke, type II diabetes mellitus and certain cancers. Globally, about 58% of diabetes mellitus and 21% of ischemic heart disease are attributable to BMI above 21 kg/m^2 [2].

Obesity predisposes an individual to a number of cardiovascular risk factors including hypertension and elevated blood cholesterol. In women, hypertension in over weight/obesity individuals is nearly three times higher in comparison with normal adult females and the risk in overweight males is nearly six times greater than in normal adult males [3].

Developing countries are increasingly faced with the double burden of hypertension and other cardiovascular diseases, along with infection and malnutrition [4,5]. Hypertension places an excessive financial burden on populations and health systems, consuming scarce resources [6]. Population-based preventive approaches are, thus, central for the management of elevated BP in developing countries, where clinic-based care for complications is not a feasible option [7-9].

Body Mass Index (BMI) is positively and independently associated with morbidity and mortality from hypertension, cardiovascular disease, type II diabetes mellitus and other chronic diseases [10]. In Caucasian populations, a strong association has been depicted between BMI and mortality [11,12]. A similar association has also been demonstrated among Asian populations [13-15].

The relationship between BMI and BP has long been the subject of epidemiological research. The relationship between BMI and blood pressure appears to be linear and exists throughout the non-obese range but the strength of the association of obesity with hypertension varies among different racial and ethical groups [16,17]. Risk estimates from the Framingham Heart Study; suggest that approximately 75% and 65% of the cases of hypertension in men and women, respectively are directly attributed to overweight and obesity [18]. Positive associations between body mass and BP have been documented in Caucasian populations [19-21]. This relationship, however, is not sufficiently explored among lean populations in Africa.

Some studies have documented a consistent, but modest association between BMI and BP [21], where as others suggested a BMI threshold at which levels the relationship with BP, begins [22]. Correlations between BMI and BP in very lean populations in Africa [23,24], and Asia [25,26] have also been reported in earlier studies.

The relationship between BMI and hypertension is of particular interest to developing countries as excess cardiovascular mortality among lean hypertensive subjects has been reported in some longitudinal studies [27-30]. Other studies that have examined the relationship between body weight and cardiovascular mortality also reported a curvilinear relationship with increased risk of mortality among the very lean and very over weight persons [31-33].

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Table 1: Mean standard error of mean, standard deviation, variance and range of the BMI of the sampled male subjects in Port Harcourt.

Age group	Number	Range	Mean±SEM	Standard dev.	Variance
21-30	62	20.74	27.11±0.65	5.12	26.28
31-40	62	31.23	27.15±0.80	6.28	39.50
41-50	25	17.69	28.29±0.86	4.30	18.49
51-60	10	13.60	28.06±1.43	4.54	20.62

From the table above, the mean body mass index of the sampled police men of age ranges 21-30, 31-40, 41-50 and 51-60 respectively are 27.11kg/m^2, 27.15kg/m^2, 28.29kg/m^2 and 28.06kg/m^2 with standard deviations of 5.12, 6.28, 4.30 and 4.54.

Table 2: Frequency of hypertension among sampled male subjects in Port Harcourt.

Age group	Number	Administration		TRAFFIC		Mobile	
		Hypertensive	Non hypertensive	Hypertensive	Non hypertensive	Hypertensive	Non hypertensive
21-30	62	12	24	8	7	2	9
31-40	62	23	21	0	2	10	6
41-50	25	3	9	0	0	7	6
51-60	10	3	4	0	0	3	0

From the table above, 12 (33.3%) and 24 (66.7%) of the administrative policemen of age group 21-30 were hypertensive and non-hypertensive. 8 (53.33%) and 7 (46.67%) of the traffic policemen of age group 21-30 were hypertensive and non-hypertensive. 2 (18.18%) and 9 (81.82%) of the mobile policemen of age group 21-30 were hypertensive and non-hypertensive. 23 (52.27%) and 21 (47.72%) of the administrative policemen of age group 31-40 were hypertensive and non-hypertensive. 2 (100%) of the traffic policemen of age group 31-40 were hypertensive and non-hypertensive. 10 (62.5%) and 6 (37.5%) of the mobile policemen of age group 31-40 were hypertensive and non-hypertensive. 3 (25%) and 9 (75%) of the administrative policemen of age group 41-50 were hypertensive and non-hypertensive. 7 (53.84%) and 6 (46.15%) of the mobile policemen of age group 41-50 were hypertensive and non-hypertensive. 3 (42.85%) and 4 (57.14%) of the administrative policemen of age group 51-60 were hypertensive and non-hypertensive. 3 (100%) of the mobile policemen of age group 51-60 were hypertensive and non-hypertensive.

The present study examines the relationship between BMI and BP among police officers in Port Harcourt. We intend to find out whether the risk of hypertension is continuously distributed at all levels of BMI, or if there are BMI groups with an increased risk of hypertension in largely lean populations.

Materials and Methods

This study was conducted amongst Police Officers from different division of Rivers State Command the Nigerian Police Force (Romuokoro, Choba, D/line, Mile 1, Mile 3, Elabushi, Woji, Moscow Headquarters, and Police clinic) within Port Harcourt metropolis. A total of 245 subjects participated in the study, comprising of 159 males and 86 females, with age range between 21-60 years. They were grouped into three based on their departments (Administration, Traffic and Mobile).

Data were collected using questionnaires and through physical measurements of weight, height and BP, using the WHO STEPS instruments. The questionnaire was translated to the respective local languages in the three countries, with only minor modifications to suit country situations. BP was measured using a digital automatic apparatus (Omron M4). Weight was measured using an ordinary scale (bathroom type), and height was measured using a wooden stadiometer, manufactured locally in the three study sites.

BP was measured, according to WHO guidelines [34], in a sitting position after the participant rested for at least 5 min. Three measurements were taken with intervals of 3 min between consecutive measurements. In addition, participants were asked whether they were taking any medications for the treatment of hypertension. Average Systolic BP (SBP) and Diastolic BP (DBP) were determined from the second and third measurements. Hypertension was defined as SBPX140mm Hg or DBPX90mm Hg or self-reported use of antihypertensive medication, with adaptation of the recent WHO definitions [34]. Weight and height were measured with participants standing without shoes and wearing light clothing. Participants stood upright with the head in Frankfort plane for height measurement. Height was recorded to the nearest 0.5 cm, and weight was recorded to the nearest 100 g.

Table 3: Mean standard error of mean, standard deviation, variance and range of the BMI of the sampled female subjects in Port Harcourt.

Age group	Number	Range	Mean±SEM	Standard dev.	Variance
21-30	32	33.70	27.31±1.08	6.13	37.67
31-40	37	33.66	31.25±1.32	8.07	65.26
41-50	16	20.00	28.67±1.24	4.97	24.70
51-60	1	0.00	22.50±0.00	0.00	0.00

From the table above, the mean body mass index of the sampled policewomen of age ranges 21-30, 31-40, 41-50 and 51-60 respectively are 27.31kg/m^2, 31.25kg/m^2, 28.67kg/m^2 and 22.50kg/m^2 with standard deviations of 6.13, 8.07, 4.97 and 0.00.

BMI was calculated as weight in kilograms over height in meters squared weight (kg)/height (m^2). The conventional BMI cutoff point as well as the recent WHO recommendation of BMI cutoff points for Asian populations [35], have been used as applicable. The distribution of mean SBP and DBP and hypertension across BMI quintiles in each of the three populations were determined separately for male and female subjects.

It is believed that the use of conventional cutoff points along with the distribution of BMI within the respective populations are complementary to each other, and would enable to examine the BMI–BP relationship from different perspectives.

Ethical clearance for the study was obtained from responsible academic or government institutions in the respective countries. Ethical clearance was obtained from the College of Health Sciences, University of Port Harcourt, Port Harcourt Nigeria, and the consent of

Table 4: Frequency of hypertension among sampled female subjects in Port Harcourt.

Age group	Number	Administration		TRAFFIC		Mobile	
		Hypertensive	Non hypertensive	Hypertensive	Non hypertensive	Hypertensive	Non hypertensive
21-30	32	10	19	3	0	0	0
31-40	37	9	19	2	7	0	0
41-50	16	8	6	0	2	0	0
51-60	1	0	1	0	0	0	0

From the table above, 10 (34.48%) and 19 (65.51%) of the administrative policewomen of age group 21-30 were hypertensive and non-hypertensive. 3 (100%) of the traffic policewomen of age group 21-30 were hypertensive. 9 (32.14%) and 19 (67.85%) of the administrative policewomen of age group 31-40 were hypertensive and non-hypertensive. 2 (22.22%) and 7 (77.78%)of the traffic policewomen of age group 31-40 were hypertensive and non-hypertensive. 8 (57.14%) and 6 (42.85%) of the administrative policewomen of age group 41-50 were hypertensive and non-hypertensive. 2 (100%) of the traffic policewomen of age group 41-50 were non-hypertensive. 1 (100%) of the administrative policewomen of age group 51-60 were non-hypertensive.

Table 5: Z-test comparing the means of the body mass index of sampled male subjects and policewomen in Port Harcourt.

Parameter	Calculated z	Tabulated z	P value	Inference
BMI	2.265	1.96	0.02	Significant difference

There is a significant difference between the means of the BMI of the sampled policemen and policewomen at $p<0.05$.

Table 6: Correlation between hypertensive state and body mass index.

Parameter		Correlation	Critical value	Inference
Hypertensive police vs. obesity	**Systole vs. bmi**	-0.738	0.403	Significant relationship
	Diastole vs. bmi	-0.369	0.312	Significant relationship
Hypertensive police vs. non obese	**Systole vs. bmi**	0.612	0.330	Significant relationship
	Diastole vs. bmi	0.027	0.330	No significant relationship
Non hypertensive vs. non obese	**Systole vs. bmi**	0.275	0.256	Significant relationship
	Diastole vs. bmi	-0.117	0.256	No significant relationship

Table 7: Relationships between hypertension and obesity in male police subjects.

Hypertensive obese	Hypertensive non-obese	Non Hypertensive obese	Non Hypertensive Non Obese
38(23.90%)	29(18.20%)	30(18.80%)	62(39.00%)

For the male police subjects, Hypertensive obese were 23.90%, Hypertensive non-obese were 18.20%, Non-Hypertensive obese were 18.80%, Non-Hypertensive obese were 18.80%, Non-Hypertensive Non-obese were 39.00%.

Table 8: Relationships between hypertension and obesity in female police subjects.

Hypertensive obese	Hypertensive non-obese	Non Hypertensive obese	Non Hypertensive Non Obese
18(20.90%)	14(16.30%)	9(10.50%)	45(52.30%)

For the female subjects, Hypertensive obese were 20.90%, Hypertensive non-obese were 16.30%, Non-Hypertensive obese 10.50%, Non-Hypertensive Non-obese 52.30%.

the Commissioner of Police (medical) of the Rivers State Command, Nigerian Police Force was also obtained. Appropriate ethical conduct was maintained throughout the study.

Statistical analysis

The values are expressed as mean ± SEM. Hypothesis testing method included one way analysis of variance (ANOVA) followed by post hoc performed with Least Significant Difference (LSD) dunnett. P value of less than 0.005 was considered to indicate statistical significance and 0.001 as highly significant respectively.

Results

A total of 245 subjects participated in the study, comprising of 159 males and 86 females, with age range between 21-60 years participated in the study. The male police subjects accounted for a total of 41 Administrative, 8 traffic and 22 Mobile officers's while the female police subjects were 27 Administrative and 5 Traffic officers, no mobile. The results of the body mass index and blood pressure of sampled police men in Port Harcourt are represented in the tables below.

Discussion

The present study examined the relationship between BMI and BP among police officers in Port Harcourt. As a result of the study location, study samples was composed of predominantly urban populations, but cuts across considerable number of ethnic groups in Nigeria due to the nature of the police force. Thus, findings from these study populations may not be much different from the situation at the national level in the respective. Race or ethnicity, biological, behavioral and environmental factors, including diet and nutrition, has been implicated as determinants of BP within and across populations [35-38]. This study, however, did not attempt to compare or explain the difference in BP between ethnic groups.

From the result as shown in (Table 1), the Body Mass Index (BMI) of the male police officer increased with age whereas that of the females appears to be independent of age. Comparison of the relationship between hypertension and obesity for both male and

Table 9: Relationships between hypertension and obesity in both male and female police subjects.

Hypertensive obese	Hypertensive non-obese	Non Hypertensive obese	Non Hypertensive Non Obese
56(22.90%)	45(17.55%)	39(15.90%)	107(43.80%)

For male and female subjects, Hypertensive obese was 22.90%, Hypertensive non-obese was 17.55%, Non-Hypertensive obese was 15.90%, and Non-Hypertensive Non-obese were 43.80%.

female subjects (Tables 2-4), 56 were hypertensive and obese, 43 were hypertensive but non-obese, 39 were non-hypertensive but obese, while 107 were non-hypertensive and non-obese.

In both the male and female subjects, those that were hypertensive and obese were more in number when compared with those that were hypertensive but non-obese and non-hypertensive and obese. From the result hypertension was more prevalent in obese subject irrespective of their sex; this is in an agreement with existing literature on body mass index and blood pressure [3,10,16-21]. From correlation coefficient it was seen that there was significant relationship between hypertension and obesity (Tables 5-9).

However, other factor apart from overweight/obesity are known to cause an increase in blood pressure which was notice while carried out this study such factor include; stress, lack of exercise excessive standing etc. It was alarming to note that almost 95% of the male and female police officers in Port Harcourt don't check their blood pressure regularly.

Conclusion

Body mass index increases with age in police subject in Port Harcourt. Hypertension was also prevalent in the overweight/obese police officers in Port Harcourt. Stress genetic factors, and lack of exercise also increases blood pressure. It is thus advised that the subject involve should check their dietary intake, maintain a healthy eating habit, exercise often and go for regular blood pressure checkup.

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