

Original Research Article

Differences in Blood Pressure Levels and Its Association with Obesity Indices among Traders in Watt Market Calabar, Cross River State Nigeria

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Abstract: The association between Obesity and Blood Pressure is well documented and a series of Obesity indices are used as risk factors or indicators of Blood Pressure or the presence of Hypertension. The objective is to observe for any relationship between Blood Pressure levels and its association with various indices of obesity by gender among traders of Watt market, Calabar. A total of 300 subjects (150 men and 150 women), aged 20-60 years were selected for the study using a convenient and random sampling technique in watt market Calabar. Weight, Height, Waist Circumference (WC), Hip Circumference (HC) and Blood Pressure were measured for each participant. Four anthropometric variables, Body Mass Index (BMI), Waist to Hip ratio (WHR), Waist to Height ratio (WHtR) were calculated and used to evaluate their association with Blood Pressure (BP). Pearson Correlation and Paired t-test analysis were used; Correlation was calculated between Systolic and Diastolic Blood Pressure and various indices of obesity. All four obesity indices used for this study were positively correlated with Blood Pressure and Hypertension. Waist to Height ratio in women and BMI in men had the strongest correlations or associations with BP. The association of Waist to height ratio in women and Body Mass Index (BMI) in men remained significant after adjustment for each of the other variables. However, BMI had the strongest correlation with continuous Blood Pressure in both genders. The association of WHR, and WC with BP and the prevalence of hypertension were a little weaker than those of BMI and WHtR in both men and women respectively. Blood pressure levels and Obesity indices increased steadily with age both in males and females. Variation in SBP was significantly correlated with all the obesity indices used in the study (BMI, WC, WHR, WHtR) in both males and females except WHtR in females. Also variation in DBP was significantly correlated with all indices of obesity (BMI, WC, WHR, WHtR) in males, but in females it had strong correlation with BMI, WHR, and WHtR. Percentage prevalence of obesity increased with age more in females than in males.

Keywords: blood pressure level, obesity indices, traders, Calabar

INTRODUCTION

Despite a growing burden of obesity and hypertension in developing countries, there is limited information on the contribution of body mass index to blood pressure (BP) in our populations. Association between BMI, other obesity indices and BP have been consistently observed in various populations [1]. This research was carried out to assess the blood pressure levels by gender in traders of Watt market in Calabar, Nigeria. To also observe for any relationship between blood pressure levels and obesity indices which include: Body Mass Index (BMI), Waist to hip Ratio (WHR), and Waist to height Ratio (WHtR), Waist circumference (WC). There is also a trend in the lifestyle and eating habit of traders as they mostly lead a sedentary lifestyle and often depend on laden salt fast food or junk while at work that predisposes them to obesity and cardiovascular diseases.

METHODOLOGY

This present study was conducted using a random sampling technique of 300 subjects (150 men and 150 women) aged 20-60 years.

- Only those who accepted and filled the consent forms that were distributed previously to them took part in the exercise.
- Only traders who stayed in their shops to sell or do their business in the shopping center were allowed to participate in the exercise. Hawkers, disabled people or individuals with structural deformities like cripples were excluded from the exercise. Pregnant women were not also allowed to take part.
- Selection of shops/stores in the shopping center at watt market.

- Since most shops are arranged in line ranging from line A, line B, line C..... etc. LineA- line was selected.
- In each of the lines, at least 20 shops were selected.
- The lines that were highly populated or dominated by men or male traders were selected and the shops along the lines that were dominated by women were also selected. The shops on the line were men and women or male and female traders were almost of the same proportion were also selected. These lines were grouped into three: group A (for shops on the lines dominated by men), group B (for shops on the lines dominated by women) and the last group C (was for the shops on the line were both men and women sold together).
- Finally, for each of the shop in each line, at least one person was picked to participate in the measurement exercise.

This study was approved by the Cross River State Health Research Ethics Committee (CRS-HREC). A pre designed questionnaire was used to record the information about descriptive data of each of the participant's age, personal dieting and lifestyle as well as detailed family history of hypertension, diabetes, arthritis, obesity, stroke, etc by interviewing the participants.

- Code no. was used to identify each participant.
- The participant's age was also recorded to the nearest complete year as given by the participants.
- Sex was recorded (male or female).

ANTHROPOMETRIC MEASUREMENT

- Weight was measured with a scale for body weight measurement; subjects were made to stand on the center of weight scale platform and weighed without shoes, wearing the least possible clothes or light clothing.
- **Height**
Standing body height was measured without shoes to the nearest 0.5cm using a commercial stadiometer with shoulders in relaxed position and arms hanging freely. The weight of the participant was evenly distributed on both feet, with the heels of the feet placed together, both heels touching the bases of the stadiometer. The buttocks, scapular and head of each of the subjects were also positioned in contact with the vertical stadiometer.
- BMI was calculated as body weight in kg divided by height in meters squared (m) the participants were classified according to BMI classification given by World Health Organization (WHO) [2].

BMI(kg/m ²)	Classification
≤18.5	Under weight
18.5– ≤ 25.0	Normal weight range
≥ 25.0– ≤ 30.0	Overweight at risk
≥ 30.0	Obese

Waist circumference:

The subjects were divided into two groups, men and women. Female medical personnel attended to the women, while male medical personnel attended to the men. The waist circumference was measured to the nearest 0.1cm and the narrowest waist or highest point of iliac crest. Cut off point for central obesity was defined as:

- 94cm for male participants.
- 88cm for female participants.

Hip circumference

Each subject was made to stand erect with feet together and weight evenly distributed on both feet, a tape was placed at the extension of the buttocks and hip circumference was measured in (cm).

Waist to hip ratio:

This was calculated with corresponding values of waist circumference divided by hip circumference. High waist to hip ratio was defined as > 0.90cm in men and > 0.80cm in women (World Health Organization 2000) [3].

Waist to height ratio:

This was calculated by dividing Waist Circumference with Height. High waist to height ratio was defined as >0.50cm for both male female subjects.

Blood pressure measurement:

Measurement was done in the morning at 8.00am Blood pressure was measured using a standard mercury sphygmomanometer. Subjects were seated on a chair with their back supported at heart level. Measurements were done after a rest of 5 minutes. The participant was made to sit comfortably with arm supported and positioned at the level of the heart. Ensuring that no tight clothing constricts the arm.

The sphygmomanometer was applied on the left arm of the subject. The first and fifth phases of Korotoff sounds were used for systolic (SBP) and Diastolic Blood Pressure (DBP) respectively. Two independent measurements for all the subjects were obtained with a minimum interval of one minute. The mean of the two Blood Pressure readings was used for each subject in this study. Blood pressure was defined among the study participants according to the seventh report of Joint National Committee on prevention, detection, evaluation and treatment of High BP.

BP	Systolic	Diastolic
Normal	<120mmHg	<80mmHg
Prehypertension	(120-139)mmHg	(80-89)mmHg
Stage 1 hypertension	(140-159)mmHg	(90-99)mmHg
Stage 2 hypertension	≥ 160mmHg	≥ 100mmHg

All measurements and data collection were conducted by two trained medical personnel between 8.am to 11.am daily except Sundays, at watt market.

Statistical Analysis

The data was analyzed using statistical package for the social sciences (SPSS) version 21.0. The population characteristic, Anthropometric

indicators, SBP, DBP was well documented, means were compared between sexes using paired t-test. Pearson correlation coefficient was used to determine the association between various obesity indices and blood pressure indicators. The level of significance was taken as P < 0.01

RESULTS

Table 1: Mean and S.D of various Anthropometric and physiological variables of Adult men and woman in watt market, Calabar

Anthropometric and physiological variables	Male (n = 150)		Female (n = 150)	
	Mean	S.D	Mean	S.D
Age (years)	35.41	9.33	34.98	9.42
SBP (mmg)	133.26	19.63	133.63	17.27
DBP (mmg)	89.65	59.52	86.73	8.55
Weight (kg)	78.60	15.83	84.66	16.96
Height (m)	1.64	0.07	1.61	0.06
BMI (kg/m ²)	29.31	6.21	32.48	6.33
WC (cm)	89.73	15.98	98.74	16.31
HC (cm)	95.72	15.98	110.45	14.34
WHR	0.93	0.06	0.90	0.07
WHtR	0.54	0.10	0.62	0.10

Table 2: Prevalence of BMI weight categories by sex

Categories	Male N	%	N	Female %
Underweight	NIL	-	NIL	-
Normal	45	30.0	20	13.3
Over weight	49	32.7	35	23.3
Obese	56	37.3	95	63.3
Total	150	100	150	100

Table 3: Percentage prevalence of obesity with different anthropometric

Sex	Total no. of subjects	% WC	% WHR	% WHtR
Female	150	70.6 (106)	84 (126)	76.7 (115)
Male	150	36.7 (55)	34.7 (52)	44.7 (67)
Total	300	53.7 (161)	59.3 (178)	60.7 (18.2)

Note: the figure in parenthesis indicates no. of subjects.

Table 4: Percentage prevalence of BP levels among Adult men and women of Watt market, Calabar

Sex	Male %	Female %	Total %
Total no of subjects.	150	150	300
Normal	(29) 19.3	(56) 37.3	(85) 28.3
Prehypertensive	(63) 42.0	(55) 36.7	(118) 39.3
Hypertensive	(58) 38.6	(39) 26.0	(97) 32.3

Note that the figures in parenthesis indicates the no. of subjects

Table 5: Percentage prevalence of hypertensive among obese and non-obese male and female

Sex	Hypertensive Subjects	BMI non Obese	WC non Obese	WHR non Obese	WHtR non Obese obese
Male	58 (150)	35.3 2.7 (53) (4)	18 20 (27) (30)	16.7 21.3 (25) (32)	21.3 16.7 (32) (25)
Female	39 (150)	36.0 1.3 (54) (2)	22.7 14.0 (34) (21)	33.3 3.3 (50) (5)	35.3 1.3 (53) (2)
Total	97 (300)	29.7 7.3 (89) (22)	20.3 16.7 (61) (50)	25.0 12.0 (75) (36)	28.0 9.0 (84) (27)

Figures in parenthesis indicates no. of subjects

Table 6: Correlation between blood pressure and obesity indices among male and female traders in Watt Marker, Calabar

Variable	Systolic	Diastolic	Systolic	Diastolic
Body mass index	0.638**	0.605**	0.554**	0.350**
Waist circumference	0.239**	0.310**	0.300**	0.153*
Waist to hip Ratio	0.229**	0.273**	0.221**	0.228**
Waist to height Ratio	0.298**	0.375**	0.360**	0.207**

* = P <0.05; ** = P < 0.01.

The general characteristics of the population study are recorded in the first table. The mean age of male was 35.41± 9.33 years and that of female 34.98±9.42. The mean SBP for females was 133.63±17.27 and 133.26± 19.63 for males. DBP mean in male individuals was (89.65±59.52) and 86.73±8.55 in females. The mean weight was 78.60±15.83kg for males and 84.66±16.96kg for females. The mean height was 1.64±0.07m for males and 1.61±0.06m for females BMI was higher in females. Than in males (32.48± 6.33)kg and 29.31± 6.21kg/m² respectively. The females had a higher mean waist to height ratio (0.62 ± 0.10 > than the males (0.54±0.10). Waist to hip ratio was seen to be marginally higher in males (0.93) than in females (0.90)

Assessment of Obesity (Table III)

The following parameters were used to assess obesity in the present study.

- Body Mass Index (BMI)
- Waist circumference (WC)
- Waist to hip ratio (WHR)
- Waist to height ratio (WHTR)

(BMI) Body Mass Index: BMI is the most common and widely used measure for classifying obese and overweight subjects for survey or research purpose. 32.7% males and 23.3% females were found to be overweight, obese persons were 37.3% and 63.3% in both men and women respectively. Thus, in the pooled sample of 300 subjects, the prevalence of obesity (obese/over weight) was 52%, men were found to be more over weigh than the women on the other hand the women were more obese than their male counter parts.

- **Waist circumference (WC):** According to WC in this study, 70.6% females and 36.7% males were obese. Thus in a pooled sample prevalence of obesity was 53.7%.

- **Waist to Hip Ratio (WHR):** From the result obtained, by calculating WHR so as to assess obesity, 54% women and 34.7% men were found to be obese. Thus a total of 59.3%
- **Waist to Height Ratio (WHtR):** Using WHtR ratio to asses for obesity, 76.7% women and 44.7% men were obese. Thus, the prevalence of obesity was 60.70%.

Weight and height measurements were higher in males than females. While waist circumference as well as hip circumference was higher in females. Females also had a higher WHR and WHtR than their male counterparts. BMI was higher in females than in males.

Assessment of Blood pressure levels (Table III & IV)

In a sample of 300 subjects (150 men & 150 women) aged 20-60 years. Among 150 men, (19.3%) were normotensive, 43.0% were prehypertensive while 38.6% were hypertensive. Among women, 26.0% were hypertensive, 36.7% prehypertensive and 37.3% normotensive.

Women had significantly increased prevalence of obesity, but blood pressure levels were higher in males (38.6%) than in females (26.0%).

However, the prevalence of hypertension was assessed in relation to various obesity parameters. The population was divided into 2 groups. I.e. Obese and non obese subjects that are hypertensive, using different anthropometric variables of obesity.

- **Body Mass Index (BMI):** Hypertension was present in 35.3% men and 36.0% women who were obese (BMI > 25kg/m²). Whereas in non-obese men and women the percentage prevalence of hypertension was 2.7% and 1.3% respectively, and in the pooled sample,

prevalence of hypertension was 29.7% in obese and 7.3% in non-obese subjects.

- **Waist circumference (WC):** Using WC in non obese men, the prevalence of hypertension was found to be 20% while among obese men it was 18%. Also for both obese and non obese women, the prevalence of hypertension was 22.7% and 14.0% respectively.
- **Waist to Hip Ratio (WHR):** According to WHR in obese male and female, percentage prevalence of hypertension was 16.70% and 33.30% respectively while in non-obese men and women it was 21.3% and 3.3% respectively. Thus, in the pooled sample, the prevalence of hypertension was 25.0% in obese and 12.0% in non-obese subjects.
- **Waist to Height Ratio (WHtR):** From the result in the study using WHtR, hypertension was present in 21.3% men and 35.3% women who were obese and 16.7% and 1.3% non obese men and women respectively. Thus, in the pooled sample, the prevalence of hypertension was seen to affect 28.0% obese and 9.0% non-obese individuals.

DISCUSSION

The results of our study indicate that prehypertension affects a larger portion of the market population in Calabar. Where prevalence of Obesity was higher among females than in males and the prevalence of hypertension was higher in males than their female counter parts. Prehypertension was associated with several other risk factors for CVD (cardiovascular diseases) with significantly higher prevalence of overweight, obesity and increase waist circumference when compared to persons or subjects with normal blood pressure as it was the case in Baniya population, in India.

We also found the prevalence of prehypertension to be 39.3% which is not too far from the findings of Ulasi *et al.*; [4] who found a prevalence of prehypertension of 32.8% in their population based survey and also 34% as found in Taiwan. These figures are not as high as those documented among the general population such as the one in Baniya which was 47.6% and those found among Egyptian adult which was 49.22%. Prehypertension studies from different regions of India and China also indicated the prevalence of prehypertension in the range of 40-60% and 40% respectively [5]. These figures are not as high as those reported from the survey in a general population when compared with the survey study in a market population. The high prevalence of hypertension among men compared to women is noteworthy and this is in agreement with other studies such as those documented among population in Amritsar district and Baniya population in India.

However, the percentage prevalence of hypertension among traders of watt market Calabar may be

attributable to differences in dietary habits, socio-economic status, sedentary lifestyle, obesity rate as well as genetic makeup. It was also evident from the present sample that a high prevalence of hypertension was noted in obese females. There is a clear indication that prevalence of hypertension varied according to BMI status. The subjects with BMI more than 25 kg/m² (obese) had a high prevalence of hypertension 29.7% than the subjects having BMI less than 25kg/m² (non-obese) which was 7.3%.

In our study, we found a significant correlation of BMI and BP in males, which is in contrast with the findings in Delhi India where BP was significantly correlated with BMI in females and correlation between BP and WC was found to be significant in male., high correlation between BP and WC in male have also been reported in other studies [6, 7]. Also in both male and female individuals, SBP was significant with BMI which is in contrast with the findings in Egypt where there was significant correlation between WC and BP (i.e. SBP and DBP) in both sexes. We found the likelihood of having hypertension to be associated with WHtR in females. Which is in contrast with the findings in Delhi, India as high correlations between BP and BMI in females and WHR in males was observed to be significant. It thus suggests that strategies should focus on healthy diet, increased physical activity and weight reduction and maintenance [8].

In the present study, the results of bivariate analysis of correlation of BMI, WC, WHR and WHtR showed that these obesity indices were significantly correlated with SBP and DBP. SBP was best associated with BMI and WHtR

CONCLUSION

Blood pressure levels and Obesity indices increased steadily with age both in males and females. Variation in SBP was significantly correlated with all the obesity indices used in the study (BMI, WC, WHR, WHtR) in both males and females except WHtR in females. Also variation in DBP was significantly correlated with all indices of obesity (BMI, WC, WHR, WHtR) in males, but in females it had strong correlation with BMI, WHR, and WHtR. Percentage prevalence of obesity increased with age more in females than in males.

Obesity was significantly associated with blood pressure levels in both sexes. This study supports the recommendation of World Health Organization (WHO) (2003), for developing countries to lay more emphasis on primary prevention community programs for promoting physical activity such as exercise, a reduction in alcohol intake, consumption of salt laden processed foods.

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