The Journal of Anatomical Sciences
Email: anatomicaljournal@gmail.com

J. Anat Sci (14) 1

The Risk of Hypertension Amongst Civil Servants in Portharcout using Waist to Hip Ratio (WHR) and Body Mass Index (BMI) as Markers

Agi CE, Yorkum LK and Chilaka OC

[1]Radiology Department, Faculty of Clinical Sciences, University of Port Harcourt & University of Port Harcourt Teaching Hospital

[2]Anatomy Department, College of Health Sciences, University of Port Harcourt,

ABSTRACT

Anthropometric indices of central obesity such as waist circumference, waist hip ratio and body mass index is one of the most important risk factors for cardiovascular diseases (CVDs) including hypertension (HT) which is itself a risk factor for CVDs. Recent studies suggest that waist circumference (WC) may be more sensitive than Body Mass Index (BMI) in determining individual risk scores for CVDs. The current study aimed at investigating the risk of hypertension among civil servants using waist to hip ratio and body mass index. A cross sectional design was employed for the study,and participants selected by convenience sampling. Informed consent was obtained from 200 male and female civil servants working in the University of Port Harcourt and measurements were performed for each participant. Blood pressure was measured and a descriptive statistical analysis done. The main mean values obtained for systolic blood pressure of male was 131.59 and the standard deviation was 16.26, while the female was 128.77 and the standard deviation was 16.76. The main mean values for diastolic blood pressure of male was 78.43 and standard deviation was 11.83, while the female was 79.95 and standard deviation was 10.93. There was no statistical significant difference when the test of significant (t-test) was conducted. The main mean values for the weight of male was 65.92 and the standard deviation was 11.74, while the female was 56.06 and the standard deviation was 12.1, indicating no statistical significant difference. The main mean values for the height of male was 165.22 and the standard deviation was 7.05 while for female was 161.77 and the standard deviation was 9.50, indicating no sexual dimorphism when the test of significance was conducted. The main mean values for body mass index for male and female were 24.95±4.26 and 22.19 ±4.34 respectively. There was statistical significant difference (sexual dimorphism) when the test of significant (t-test) was conducted. Moreso, there was no statistical significant difference when the test of significance (t-test) was conducted for waist circumference (WC), where the male and female mean values were 37.05±4.03 and 38.00±4.86 respectively. The mean values for hip circumference of male and female were repectively 41.72±5.07 and 42.26± 5.13 with no statistical significant difference following the test of significance (t-test). There was significant correlation between anthropometric indices of central obesity such as WC, WHR and BMI with hypertension. The study indicated that there is an increased risk in hypertension when; waist circumference, waist-to-hip ratio and BMI are high.

Key word: Hypertension, Waist-to-Hip Ratio, Body Mass Index, University of Port Harcourt, Civil Servants.

INTRODUCTION

Hypertension is a long-term condition where blood pressure is increased. It is the leading cause of death worldwide, affecting more than 1.4 billion people and accounting for more than 28,000 deaths each day. Initially, it does not cause any symptoms but if left untreated it can lead to stroke, heart attack, kidney disease, vision loss, and dementia. Control of high blood pressure can help protect against these conditions and there are many steps that can be taken to help lower blood pressure[1]. Hypertension is a complex condition with many causes including lifestyle factors, such as physical inactivity, a salt-rich diet with high processed and fatty foods, and alcohol and tobacco use. Unfortunately the incidence of hypertension is increasing at an alarming rate from developed countries to emerging economies, such as India, China and African countries.

Hypertension is a chronic health condition in which the pressure in the arteries is elevated, globally, the burden of non-communicable disease (NCDs) including hypertension is increasing rapidly and reports from the 2013 World Health day global brief on hypertension shows that Africa continent maybe the worst affected region in the world. It is estimated that hypertension affects about one billion people and it is a major risk factor for many cardiovascular disease. Primary hypertension is the most prevalent type, affecting between 90-95 percent of patients diagnosed with hypertension. Primary hypertension does not have a clearly identifiable known etiology. This differentiates primary from secondary hypertension, in which blood pressure elevation occurs secondarily to another identifiable cause[1]. Although primary hypertension is unidentifiable cause, however, the risk factors of primary hypertension have been found in the literatures. Many studies have indicated several risk factors of primary hypertension, such as age, body mass index (BMI), smoking and alcohol consumption[2,3,4] (Agrawal, Bhalwar, & Basannar, 2008; Bani, 2011; Chataut, Adhikari, & Sinha, 2011).

The body mass index (BMI) is the metric currently in use for defining anthropometric height/weight characteristics in adults and for classifying (categorizing) them into groups. The common interpretation is that it represents an index of an individual's fatness. It also is widely used as a risk factor for the development of or the prevalence of several health issues. In addition, it is widely used in determining public health policies.The BMI has been useful in population-based studies by virtue of its wide acceptance in defining specific categories of body mass as a health issue. However, it is increasingly clear that BMI is a rather poor indicator of percent of body fat. Importantly, the BMI also does not capture information on the mass of fat in different body sites[5](Beaver et al.2007).

Waist- to-hip (WHR) ratio is an anthropometrical body shape measurement. It is calculated as the ratio of the distance at it's narrowest point around the waist (waist circumferences) and the distance at its widest point around the hips and buttocks at the level of the greater trochanter(hip circumference).In human mate preference evolutionary theory, WHR was proposed to have developed as a signal of age, fitness and fertility in women through sexual selection. Your waist-to-hip ratio compares

your waist measurement to your hip measurement. Higher ratios can mean you have more fat around your waist. This can lead to a higher risk for heart disease or diabetes.

The aim of the study was to investigate the risk of hypertension among civil servants using waist to hip ratio and body mass index as markers.

MATERIALS AND METHODS

Study Area: The study was conducted in the university of port Harcourt, located in the city of port Harcourt, Rivers State, Nigeria ,amongst male and female civil servants working in the university of Port Harcourt

Study Design: A cross-sectional design was employed for the study,

The study was conducted amongst male and female civil servants working in the university of Port Harcourt, using convenience sampling technique

Study Population: Participants were selected by convenience sampling amongst civil servants working in the University of Port Harcourt. sample size of 300 was estimated to be adequate. Sample was collected equally from male and female participants to eliminate bias. participants not within the age range of 18-65,and not civil servant in the university of Port Harcourt were excluded for the research

The sample size was determined using the formula for calculating sample size for cross-sectional studies.

The formula is as follows;

$n = Z^2 p (1 – p) / d^2$

Where;
n: Sample size
Z: Standard minimum deviate
p: Expected prevalence
d: Degree of accuracy or error

Instrument for Data Collection: Data for this study was collected from a primary source using a digital sphygmomanometer, digital weighing scale and a measuring tape, and values documented appropriately.

Body mass index, was calculated according to the formula; weight/ height, where weight is expressed in kilograms and height in metres.

Waist-hip ratio was calculated with the formula waist girth / hip girth, both expressed in centimetres.

A cross sectional study was carried out on the civil servants working in university of Port Harcourt. Due consent was taken from all participants after the purpose of the study was explained to them. Anthropometry and blood pressure measurements were performed in the comfort of each participants office.

Height: All participants were requested to take off all shoes and headgears for this procedure. Height was measured while the participant was standing with heels together, the body held in a maximally erect position and head held in the Frankfurt plane. Height was measured to the nearest 0.1 cm. using a measuring tap**e**

Waist and hip circumference measurements: Waist and hip circumferences were measured using WHO STEPS protocol. Briefly, participants were advised to stand erect with both feet

together, arms at the side and not retract abdomen during measurement. A non-elastic measuring tape was used to determine WC at the smallest diameter of the waist and HC at the widest diameter of the buttocks. All measurements were recorded to the nearest cm.

Weight determination: Weight was determined using a digital weighing scale. Participants were requested to take off all heavy clothing, shoes and socks and to step with bare feet on the scale. Weight was measured to the nearest 0.1 kg.

Blood pressure measurement: Blood pressure was measured using the right arm for all participants after 10 minutes of rest in the seated position using a digital sphygmomanometer. The cuff was placed and evenly tightened around the upper right arm 2 cm away from the elbow joint. Systolic and diastolic blood pressure as well as heart rate were automatically measured by the BP monitor. Three blood pressure measurements were taken and the average values computed. Normal blood pressure was defined as; Mean systolic blood pressure (MSBP) <120 mmHg and mean diastolic blood pressure (MDBP) <80 mmHg. Pre-hypertension as MSBP from 120-139 mmHg and MDBP from 80-89 mmHg, while Hypertension was defined as MSBP ≥140 mmHg and MDBP ≥90 mmHg[6] (Meier et al, 2013)

Statistical Analysis: The raw data derived was analyzed using descriptive analysis to determine the percentage of the variables. A T-test was also performed to further analyze the data.

RESULTS

RESULTS PRESENTATION

The table below showed the descriptive statistical analysis of mean, standard deviation, standard error, the systolic, diastolic, weight, height, Body mass index, waist, hip of male and female civil servants in the University of Port Harcourt, the main mean values for systolic blood pressure of male was ±131.59 and the standard deviation was ±16.26 while the female was ±128.77 and the standard deviation was ±16.76.

They main mean values for diastolic blood pressure of male was ±78.43 and the standard deviation was ±11.83 while the female was ±79.95 and the standard deviation was ±10.93. There was no statistical significant difference or no sexual dimorphism the t test of significant (t-test) was conducted.

They main mean values for the weight of male was ±65.92 and the standard deviation was ±11.74 while the female was ±56.06 and the standard deviation was ±12.10, therefore there was statistical significant difference and sexual dimorphism when the test of significant (t-test) was conducted.

They main mean values for the height of male was ±165.22 and the standard deviation was ±7.05 while for female was ±161.77 and the standard deviation was 9.50, there is no statistical significant difference or no sexual symbolism when test significant (t-test) was conducted.

They main mean values for body mass index for male was ±24.95 and the standard deviation was ±4.26 while the female was

±22.19 and standard deviation was ±4.34, There was statistical significant difference and sexual dimorphism when the test of significant (t-test) was conducted.

They main mean values for waist of male was ±37.05 and standard deviation was ±4.03 while for female was 38.00 and standard deviation was ±4.86, Therefore there was no statistical significant difference or no sexual dimorphism when the test of significant (t-test) was conducted.

They main mean values for hip of male was ±41.72 and standard deviation was ±5.07 while for the female was ±42.26 and standard deviation was ±5.13,therefore there was no statistical significant difference or no sexual dimorphism when the test of significant (t-test) was conducted.

Table 1: Showing Association with gender using independent T- test

	Gender	Mean	Std. Deviation	Minimum	Maximum	Variance	Std. Error of Mean
Systolic	female	128.7700	128.7700	97.00	191.00	281.492	1.67777
	male	131.5900	16.26429	96.00	1.62643	264.527	1.62643
BP diastolic	female	79.9500	11.83248	54.00	110.00	140.008	1.18325
	male	78.4300	10.93438	52.00	100.00	119.561	1.09344
Weight	female	56.0637	12.10476	.00	99.25	146.525	1.21048
	male	65.9213	11.73885	40.30	90.00	137.801	1.17388
Height	female	161.7700	9.50582	137.00	182.00	90.361	.95058
	male	165.2260	7.05136	152.00	182.00	49.722	.70514
body mass index	female	22.1970	4.34986	17.70	42.10	18.921	.43499
	male	24.9540	4.26530	18.70	40.00	18.193	.42653
Waist	female	38.0000	4.85757	29.00	58.00	23.596	.48576
	male	37.0500	4.03363	28.00	46.00	16.270	.40336
Hip	female	42.2600	5.13774	32.00	59.00	26.396	.51377
	male	41.7200	5.06938	32.00	59.00	25.699	.50694

Table 2: Showing Association with gender using independent T- test

	Gender	N	Mean	Std. Deviation	Std. Error Mean	t-score	Significant
Systolic	female	100	128.7700	16.77772	1.67777	-1.207	0.229
	male	100	131.5900	16.26429	1.62643		
BP diastolic	female	100	79.9500	11.83248	1.18325	943	0.347
	male	100	78.4300	10.93438	1.09344		
Weight	female	100	56.0637	12.10476	1.21048	-5.846	0.000
	male	100	65.9213	11.73885	1.17388		
Height	female	100	161.7700	9.50582	.95058	-2.920	0.004
	male	100	165.2260	7.05136	.70514		
body mass index	female	100	22.1970	4.34986	.43499	-4.526	0.00
	male	100	24.9540	4.26530	.42653		
Waist	female	100	38.0000	4.85757	.48576	1.505	0.134
	male	100	37.0500	4.03363	.40336		
Hip	female	100	42.2600	5.13774	.51377	.748	0.455
	male	100	41.7200	5.06938	.50694		

Table 3: Showing Paired Sample Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Systolic	130.1800	200	16.54194	1.16969
	waist to ratio	.8964	200	.07078	.00500
Pair 2	BP diastolic	79.1900	200	11.38914	.80533
	waist to ratio	.8964	200	.07078	.00500
Pair 3	body mass index	23.5755	200	4.51371	.31917
	waist to ratio	.8964	200	.07078	.00500

Table 4: Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	sytolic & waist to ratio	200	.089	.210
Pair 2	BP diastolic & waist to ratio	200	.082	.246
Pair 3	body mass index & waist to ratio	200	-.040	.570

Table 5: Showing Paired Sample Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	sytolic - waist to ratio	129.28359	16.53580	1.16926	126.97787	131.58932	110.569	199	.000
Pair 2	BP diastolic - waist to ratio	78.29359	11.38352	.80494	76.70629	79.88089	97.267	199	.000
Pair 3	body mass index - waist to ratio	22.67909	4.51712	.31941	22.04923	23.30895	71.003	199	.000

DISCUSSION

The current study shows a slight blood pressure mean difference between male and female respondants, with an increase in male systolic blood pressure of about 131.5900 and that of female been 128.7700. The following gives the impression of gender been one of the factors leading to hypertension, this is collobrated by the longitudinal study carried out by Bethany et al [7]. Their results showed that disparity in hypertension status were already evident among men and women in their twenty's; with women been far likely to be hypertensive compared to men(12% vs 27%).

There was also difference in BMI between male and female voluteers, with the average mean of the male BMI been 24.9540, while that of females was 22.1970, previous studies have also collaborated gender difference to BMI. According to a study done by Zhang et al[8], there was a higher proportion of overweight/obese men than women.this can be reflected in the result found in the weight and height of male and female respondents of this study with the mean height of males versus female been 165.2260 and 161.7700 respectively and weight been 65.9213 and 56.0637 respectively

In the present study, there was a significant correlation between anthropometric indices of central obesity such as WC, WHR, BMI with hypertension. The study indicates an inverse proportional relationship between the maximum blood pressure recorded and the minimum waist circumference recorded and a direct proportional relationship of the minimum blood pressure recorded and the minimum waist circumference recorded. This infers that higher waist circumference is a risk factor for hypertension, in other words higher the waist circumference the greater the blood pressure and the risk of developing hypertension, this association of waist circumference and blood pressure was a similar trend for both gender in the study not showing any gender bias in pattern of association.

In the present study the mean systolic blood pressure was higher in individuals with waist circumference more than the gender specific cut off value in overweight and normal weight group classified by BMI. Various studies have also shown that there is a strong correlation between the Waist circumference index and hypertension, especially in women, which can be attributed to the differences in the effect of hormones on the distribution of body fat in women , this is According to Guagnano *et al.*[9] who reported that among males with waist circumference more than normal,the odds ratio for hypertension was three times that of males with normal WC; females with WC more than normal had a risk for hypertension twice that of female with normal WC. The following observation infers that WC can be a more pointer to hypertension than BMI, this was supported by by the study of Jassen et al[10] who reported waist circumference and not BMI explains obesity related health risk including hypertension. Cardiovascular diseases have been found by other researchers to correlate strongly with the parameters considered in the present studies [11,12,13,14,15].

CONCLUSION

In the present study, there was significant correlation between anthropometric indices of central obesity such as WC, WHR and

BMI with hypertension. The study indicates an increase risk in hypertension when waist circumference, waist to hip ratio and BMI is high.

REFERENCES

1. Gunderson EP, Murtaugh MA, Lewis CE et al. Excess gains in weight and waist circumference associated with childbearing: The Coronary Artery Risk Development in Young Adults Study (CARDIA). *International Journal of Obesity and Related Metabolic Disorders,* 2004; 28(4):525-535.
2. Adhikaris, Grawal. Definition, diagnosis and classification of hypertension and its complications 1 diagnosis and classification of hypertension provisional report of a WHO consultant. and cardiometabolic risk in Chinese population: A cross-sectional study (J). BMJ open, 2008; 9 (9): e028904.
3. Banish, Bhalwal VII, Masood Q. Relationship among fatness,the diagnosis of hypertension base on the average ofteopr more properly measured seated, journal of health, population and nutrition, 2008; 23(1)34-43 PMID:15884750.
4. Chataut, Bani(2011) many studies have indicated several risk factors of primary hypertension such as age,body mass index(Bmi).
5. Beaver JD, Lawrence AD, van Ditzhuijzen J, Davis MH, Woods A, Calder AJ. Individual differences in reward drive predict neural responses to images of foods. Journal of Neuroscience. 2006;26:5160–5166. Meier P, Messerli F, Baumbach A, Lansky AJ.
6. Pre-hypertension: another "pseudodisease"? BMC Medicine 2013; 11: 211-213. [cited 2015 January 30]. Available from: http://www.biomedcentral.com/content/pdf/1741-7015-11-211.pdf
7. Bethany E and Anna Zajacova. Gender Differences in Hypertension and Hypertension Awareness Among Young Adults. Biodemography Soc Biol. 2015; 61(1): 1–17. doi: 10.1080/19485565.2014.929488.
8. Zhang C, Rexrode KM, van Dam RM et al. Abdominal obesity and the risk of all-cause, cardiovascular, and cancer mortality: sixteen years of follow-up in US women. *Circulation,*
   a. 2008, 117(13):1658-1667.
9. Guagnano Maria T, Ballone E, Colagrande V et al. Large waist circumference and risk of hypertension. International Journal of Obesity, 2001; 25(9):1360-4
10. Janssen I, Katzmarzyk PT, Ross R. Waist circumference and not body mass index explains obesity-related health risk. Am J Clin Nutr. 2004;79:379–384. [PubMed] [Google Scholar].
11. APCSC. Central obesity and risk of cardiovascular disease in the Asia Pacific Region. *Asia Pacific Journal of Clinical Nutrition,* 2006, 15(3):287-292.
12. Yusuf S, Hawken S, Ounpuu S et al. Obesity and the risk of myocardial infarction in 27,000 participants from 52 countries: a case-control study. *Lancet,* 2005, 366(9497):1640-1649.
13. Gelber RP, Gaziano JM, Orav EJ et al. Measures of obesity and cardiovascular risk among men and women. *Journal of the American College of Cardiolog,* 2008, 52(8):605-615.
14. Zhu S, Heymsfield SB, Toyoshima H et al. Race-ethnicity-specific waist circumference cutoffs for identifying cardiovascular disease risk factors. *American Journal of Clinical Nutrition,* 2005,81(2):409-415.