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The Risk of Hypertension in Female Adult staff of FUTA using Waist to Hip Ratio & Body Mass Index as markers

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ABSTRACT
This study was conducted to investigate the risk of hypertension in female adult staff of FUTA using Waist to Hip Ratio (WHR) and Body Mass Index (BMI) as indicators. Three hundred female adults were included in this study. With the use of standard anthropometric procedures, their height, weight, waist and hip circumferences was measured to determine the BMI and WHR. Blood pressure was also measured and Mean Arterial Pressure (MAP) was determined. Data collected was analysed using SPSS version 23.0 for Pearson correlation. The result showed significant correlation between BMI and SBP, BMI and DBP and BMI and MAP. WHR showed no significant correlation with all the variables compared with it. According to this study, age grouping was not relevant.

Key words: Hypertension, Body mass index, Waist to hip ratio, Heart.

INTRODUCTION
When the heart contracts against the resistance of the blood vessels, blood pressure is generated. Hypertension is a chronic health condition in which the pressure in the arteries is elevated [(1)]. Globally, the burden of non-communicable diseases (NCDs) including hypertension is increasing rapidly andreports from the 2013 World Health Day global brief on hypertension shows that African continent may be the worst affected region in the world [(2,3)]. It is estimated that hypertension affects about one billion people and it is a major risk factor for many cardiovascular diseases[(2)].

The standard of living and nutritional status continue to increase especially in developing countries due urbanisation and industrialisation. This has led to increase in weight gain and obesity, which are posing a threat to the health of the citizens. The most prevalent form of malnutrition in developing countries is obesity which has been proven through studies to be associated with elevated systolic and diastolic blood pressure, dyslipidemia, diabetes, etc[(4,5,6)].

Body Mass Index (BMI) is a measure of the human body weight in relation to the height, calculated by dividing the weight of a person in Kg by the square of the height in meters[(7)]. The World Health Organisation classifies BMI as underweight (<18.5kg/m^2)normal (18.5–24.9 kg/m^2), overweight (25.0–29.9 kg/m^2), obese (30.0-34.9 kg/m^2) and morbidly obese (>35.0kg/m^2).*BMI = Weight (kg) ÷ Height (m^2)*

BMI has been widely accepted as one of the best indicators of nutritional status in adults. BMI and skinfold measurement have been identified as important in estimating risk factors for cardiovascular diseases due to their positive relationship with hypertension[(8)]. Body mass index is positively and independently associated with morbidity and mortality from hypertension, cardiovascular disease, type II diabetes mellitus, and other chronic diseases [(9)]. The research carried out by George *et al.*[(19)]. showed that an increase in BMI positively influenced blood pressure among adults' population.

Waist-to-hip (WHR) ratio is an anthropometrical body shape measurement. It is calculated as the ratio of the distance at its narrowest point around the waist (waist circumference) and the distance at its widest points around the hips and buttocks at the level of the greater trochanter (hip circumference). In human mate preferences evolutionary theory, WHR was proposed to have developed as a signal of age, fitness, and fertility in women through sexual selection [(10)].

The following table shows how the WHO classified the risk of being affected by weight related health conditions according to WHR.

Table 1: Cut-off points of WHR

Health risk	Men	Women
Low	≤ 0.95	≤
Normal	0.96-1.0	0.81-0.85
High	≥	≥

WHR has also been found to be more efficient predictor of mortality in older people, cardiovascular diseases and cardiovascular risk factors, myocardial infarction, body fat distribution, stroke, premature death, hypertension, and type 2 diabetes [6, 11, 13, 14 &15].

Obesity and excess body weight are considered to be risk factors for high Blood Pressure (BP) Particularly, accumulation of central body fat is associated with both hypertension and insulin resistance. The latter condition is more frequent in overweight than in lean individuals, and also more common in hypertensive individuals than in matched normotensive controls. Thus the case has been made for a possible pathogenetic role of insulin resistance and the attendant chronic hyperinsulinemia in the development of hypertension[10].

MATERIALS AND METHODS

This study was a cross sectional population based study. The sample of the respondents was obtained from the population of academic and non-academic female staff of the Federal University of Technology Akure, Ondo state, Nigeria. The sample included three hundred (300) adult female staff of FUTA. The study was conducted using a well-structured questionnaire to collect information on socioeconomic status and to record anthropometric measurements.

Anthropometric measurements (weight, height, waist and hip circumferences) were taken using the weighing scale, metre rule and non-stretchable measuring tape respectively. Blood pressure was measured using mercury-in-glass sphygmomanometer.

Weight was measured with a weighing scale in kg while the respondent was standing on the weighing scale and wearing thin clothing. The respondents were asked to remove their shoes to avoid alteration of values. Weight was measured to the nearest 0.1kg. Height was measured using a metre rule in centimetres. The measurement was taken from the highest point of the head (vertex) to the soles of the feet to the nearest 0.1cm. The respondents were asked to remove their shoes to avoid value alteration. Waist and hip circumferences were measured using a non-stretchable measuring tape in centimetres. Waist circumference was taken at the midway between the last palpable rib and the iliac crest which is about an inch above the umbilicus. Hip circumference was taken at the level of the greater trochanter.

Blood pressure was measured using a mercury-in-glass sphygmomanometer. The respondent was asked to rest for some minutes, and then the cuff was placed on the arm of the respondent about an inch above the cubital fossa. The arm was placed in a resting position at the level of the heart before measurements. The Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) measurements were taken twice and recorded in mmHg. Mean Arterial Pressure (MAP) was calculated as $1/3(SBP - DBP) + DBP$.[11]

WHR was calculated as the division of the value of waist circumference by that of hip circumference. Classification was based on a BMI was calculated as the weight divided by the square of the height. The formula gives a unit of Kg/m^2.

BMI = Weight (kg) ÷ Height (cm)

Statistical Analysis

The data was collated, computed and analyzed using Statistical Package for Social Sciences (SPSS) version 23.0. Pearson Chi-square test was used to determine the correlation between the parameters. A p-value ≤ 0.05 was considered significant.

RESULTS

This study investigates the risk of hypertension among parous female staff of FUTA using WHR and BMI as markers. The results obtained from the statistical analysis of the anthropometric measurements and data collected are shown in the tables below. A total of 300 female staff were included in this study.

Table 3 showed the frequency and percentage of the respondents in three WHR categories. It was presented in the table that 38(12.7%) have low WHR, 88(29.3%) have normal WHR, and 174(58.0%) have high WHR. The table showed that many of the respondents have high WHR which accounted for 174 (58.4%) of the total sample size.

Table 4 showed the frequency and percentage of the respondents in four BMI categories. It was presented in the table that 96(32.0%) have normal BMI, 137(45.7%) are overweight, 57(19.0%) are obese and 10(3.3%) are morbidly obese The table showed that many of the respondents are overweight which accounted for 137 (45.7%) of the total sample size. The table also showed no incidence of underweight category among the respondents.

Table 5 presented the mean and standard deviation of the variables such as Waist to Hip Ratio, Body Mass Index, Systolic Blood Pressure, Diastolic Blood Pressure, Age

and Mean Arterial Pressure.

Table 6 presented the results of Pearson correlation using 95% confidence interval ($p \leq 0.05$). The results obtained showed there was significant correlation between BMI and SBP, BMI and DBP and BMI and MAP. The results also showed no significant correlation between WHR and the entire variable compared with it. The age grouping for this research was not relevant due to the fact that, comparison of age with WHR and BMI showed no significant correlation.

Table 2: WHR Categories

Categories	WHR values	Frequency	Percentage (%)
Low WHR	$\leq$	38	12.7
Normal WHR	0.81-0.85	88	29.3
High WHR	$\geq$	174	58.0

Table 3: BMI Categories

Categories	BMI values (Kg/m^2)	Frequency	Percentage (%)
Normal	18.-24.9	96	32.0
Overweight	25.0-29.9	137	45.7
Obese	30.0-34.9	57	19.0
Morbidly obese	>35.0	10	3.3

Table 4: Mean and standard deviation of variables

	WHR	BMI	SBP	DBP	AGE	MAP
Mean	0.86	2.94	2.14	1.97	42.48	91.30
SD	0.46	0.80	0.35	0.45	8.90	7.34

Table 5: Comparison of variables

Parameters	Pearson correlation	2-tailed sig	Significance
BMI and WHR	0.110	0.058	Not significant
BMI and SBP	0.128	0.027	Significant
BMI and DBP	0.176	0.002	Significant
BMI and AGE	0.111	0.555	Not significant
BMI and MAP	0.224	0.000	Significant
WHR and SBP	-0.020	0.729	Not significant
WHR and DBP	0.028	0.627	Not significant
WHR and AGE	0.029	0.614	Not significant
WHR and MAP	0.096	0.096	Not significant

Confidence interval = 95%, $p \leq 0.05$.
Sig= significance

DISCUSSION

Obesity and excess body weight have been well recognized as riskfactors for high Blood Pressure (BP) [10]. Particularly, accumulation of central body fat is associated with both hypertension and insulin resistance [16].

The study was conducted in order to investigate the risk of hypertension among adult females using WHR and BMI as markers. The study revealed that many of the respondents have high WHR and very few have low WHR. In the BMI categories, the overweight category was prevalent among the respondents and there was no incidence of underweight category.

The study further revealed significant correlation between BMI and SBP, BMI and DBP, BMI and MAP. This significant correlation is in consonance with the research carried out by Frederick which [4]. showed that an increase in BMI positively influenced blood pressure among adults' population. The study carried out by Mungriephy *et al.*[9] also demonstrated that BMI is closely related to both systolic and diastolic blood pressure.

According to the research carried out by Sanya *et al*.[19], WHR and BMI are closely associated with hypertension regardless of the gender. In contrast to this, our results revealed there was no significant correlation between WHR and all the variables paired with it.

CONCLUSION

Conclusively, according to this study, BMI has a significant relationship with blood pressure and will be a better marker of the risk of hypertension than WHR.

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