Relationship of Waist-Hip Ratio and Body Mass Index to Blood Pressure among Adult Female Students

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ABSTRACT

The relationship between waist - hip ratio (WHR) and body mass index (BMI) with blood pressure has not been much studied among healthy female in India. Therefore, this study was undertaken to test the relative efficacy of waist hip ratio (WHR) and body mass index (BMI) to predict blood pressure among healthy college going female.

Thirtyone (31) healthy female college students, who participate in regular physical/sports activities, were tested on height, weight, hip circumference, waist circumference, systolic blood pressure and diastolic blood pressure. Standard anthropometric techniques and formula were used. Pearson's product moment correlation and multiple regression analysis were employed to analysis the data.

There was significant relationship (p=.05) between body mass index (BMI) with systolic blood pressure (r=.42) and with diastolic blood pressure (r=.45). Further regression analysis revealed that body mass index (BMI) explained 15% of variance of systolic blood pressure and 18% of variance of diastolic blood pressure among healthy college sports women. However, waist hip ratio (WHR) has not found significant relation with systolic and diastolic blood pressure.

INTRODUCTION

The World Health Organisation reports that the average blood pressure went down by 2.7mm mercury among women globally, while increasing by 2.4mm mercury in India. In men, it decreased by 2.3 mm mercury globally in the past three decades but in India it went up by 2.2 mm mercury. High blood pressure is the leading risk factor for cardiovascular disease mortality, causing more than 7 million deaths every year, worldwide. The Harvard study presented at the World Congress of Cardiology, in Dubai, says around 900 million people, in developing countries have high blood pressure; but, only one-third are aware of their disease. Moreover, only 100 million of these people receive treatment, while

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only 5% of the total is controlled. High blood pressure is twice as common in adult who are obese than those who are healthy (Times of India, 22 April, 2012). Obesity is associated with high triglycerides and decrease HDL cholesterol.

A person with central abdominal obesity, characterised by excessive visceral fat and abdomen have higher risk of weight related disease. Increased body fat is accompanied by profound changes in the physiological and metabolic functions of the body, which are directly dependent on the degree of excess weight and on its distribution around the body. Body mass index has been identified by the World Health Organization (WHO) as the most useful epidemiological measure of obesity. However, it does not take into account the distribution of body fat, resulting invariability in different individuals and populations (WHO, 2000). Hence, other anthropometric indices like waist circumference and hip measures the central distribution of fat. Waist hip ratio has been recommended as a simple and practical measure for identifying overweight and obese patients. It is particularly useful for individuals and population groups with different body builds (Larson et al, 1984; Lapidus et al, 1984; Welborn et al, 2003). Seidell et al (1989) have suggested that BMI was the best overall predictor for both systolic and diastolic blood pressure for women. However, Enrique Rivero (2009) study revealed that waist-hip ratio better than BMI for gauging obesity in elderly. Therefore, present study was an attempt to identify relationship of body mass index (BMI) and waist-hip ratio (WHR) with systolic and diastolic blood pressure, among healthy college going female subjects.

METHODOLOGY

Participants

Thirtyone (31) healthy female college students (Mean age 21.13±2.05), who participated in regular physical sports activities, were tested on height, weight, hip circumference, waist circumference, systolic blood pressure and diastolic blood pressure. Standard anthropometric techniques and formula were used to determine the body mass index (BMI) and waist-hip ratio (WHR). The selection was by a random sampling with the cooperation and readiness of the participants, after their informed consent.

Instrumentations

Standard instruments like Gulick Tape, Stadiometre, Sphygmomanometer and portable weighing scale were used by female researcher to collect the data.

Statistical analyses

Data was analyzed by SPSS (Statistical Package for Social Sciences, Version 17, SPSS). Descriptive statistics, Pearson's Correlation Test, regression analysis and ANOVA were used to investigate the relationship between the body mass index (BMI) and waist-hip ratio (WHR) and systolic and diastolic blood pressure.

RESULTS & DISCUSSION

Table 1 presents the descriptive statistics of body mass index (BMI), waist-hip ratio (WHR), systolic blood pressure, diastolic blood pressure,

body weight, height, waist circumference and hip circumference. All the parameters are of normal range, as per World Health Organisation (WHO) norms.

Table-1 : Descriptive Statistics

Variables	Range	Minimum	Maximum	Mean	Std. Deviation
Body mass index (BMI)	13.85	17.17	31.02	22.18	2.90
Waist hip ratio (WHR)	.17	.71	.88	.80	.04
Systolic blood pressure	23.00	94.00	117.00	107.83	6.33
Diastolic blood pressure	24.00	59.00	83.00	70.38	6.67
Weight (kg)	38.82	36.58	75.40	51.95	7.94
Height (mtrs)	.18	1.46	1.64	1.52	.05
Waist circumference (cm)	35.00	58.00	93.00	74.53	6.87
Hip circumference (cm)	27.34	81.66	109.00	92.26	5.41

N=31

Table-2 : Correlation Matrix among Independent and Dependent Variables

	BMI	WHR	SBP	DBP	weight	height	WC	HC
Body mass index	1							
Waist hip ratio	.549*	1						
Systolic blood pressure	.423*	.095	1					
Diastolic blood pressure	.455*	.000	.596*	1				
Weight	.911*	.415*	.500*	.520*	1			
Height	.227	-.027	.385*	.364*	.602*	1		
Waist circumference	.901*	.783*	.332	.323	.857*	.315	1	
Hip circumference	.925*	.463*	.454*	.522*	.950*	.465*	.896*	1

N=31 *Significant at r0.05 (29) =.355

Table 2 presents body mass index (BMI) which has significant relationship with systolic blood pressure (r=.42) and with diastolic blood pressure (r=.45). However, there is no significant relationship between waist-hip ratio with systolic blood pressure and diastolic blood pressure. Significant relationship was found between body mass index (BMI) and waist-hip ratio (WHR), and between systolic blood pressure and diastolic blood pressure (r=.54), and (r=.59), respectively.

Table-3 : Regression Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.42a	0.17	0.15	5.83

a. Predictors: (Constant), body mass index

b. Dependent variable: systolic blood pressure

Table 3 presents model summary of regression analysis which showed body mass index explained the 15% of variance (as adjusted R Square value is .05) of systolic blood pressure; and this model is significant at .05 level, as F value= 6.3 (ANOVA)was significant at .05 level.

Table-4 : Regression Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.45[a]	.20	.18	6.04

a. Predictors: (Constant), body mass index

b. Dependent variable: diastolic blood pressure

Table 4 presents model summary of regression analysis which showed body mass index explained the 17% of variance (as adjusted R Square value is .17) of systolic blood pressure, and this model is significant at .05 level, as F value 6.3 was significant.

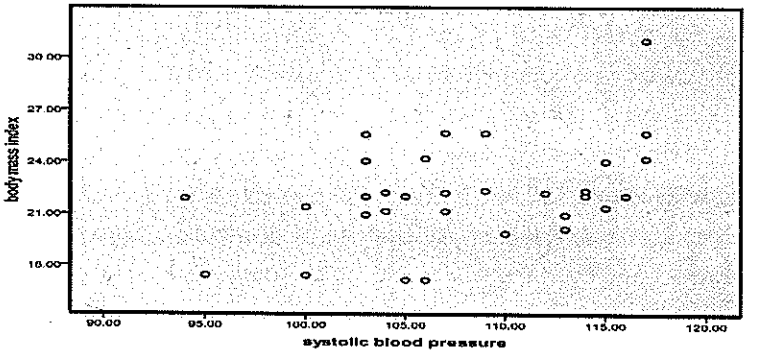

Figure-1 : Relationship of Body Mass Index (BMI) with Systolic Blood Pressure

Figure 1 presents the scatter graph of body mass index (BMI) with systolic blood pressure, linear relationship was found between this two variables.

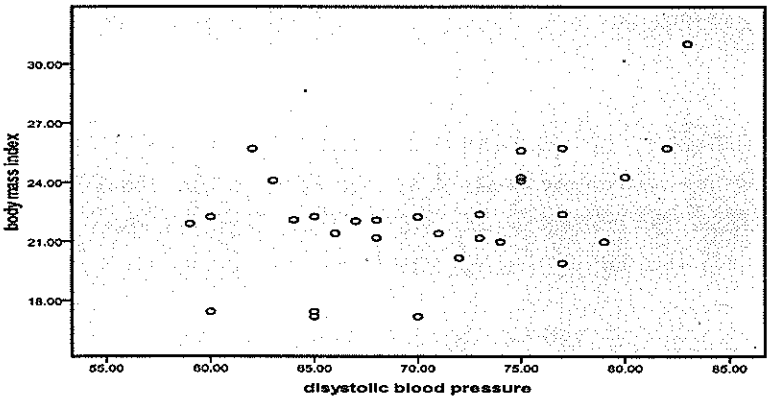

Figure-2 : Relationship Body Mass Index (BMI) with Diastolic Blood Pressure

Figure 2 presents the scatter graph of body mass index (BMI) with diastolic blood pressure, linear relationship was found between these two variables.

Finally, two regression equations have been developed in order to predict the cardio vascular risk factor, i.e., systolic blood pressure and diastolic blood pressure. Where Y1 and Y2 are the predicted systolic and diastolic blood pressures and 87.42 and 47.19 are predictors constant, X1 and X2 are raw scores of body mass index (B.M. I) of subjects and 0.93 and 1.05 are unstandardized B coefficients value for equation 1 and 2, respectively.

1. $Y1=87.42+(X1)\times0.93$
2. $Y2=47.19+(X2)\times1.05$

The more obese a person is, the more likely he or she is to develop health problems. Mild obesity involving a body mass index (BMI) of 30+ is less dangerous to health than morbid obesity (BMI 40+) or malignant obesity (BMI 50+). Obesity has been particularly recognized as a major independent risk factor for cardiovascular diseases (Despres, 2001). This is because increased body fat is accompanied by profound changes in the physiological and metabolic functions of the body, which are directly dependent on the degree of excess weight and on its distribution around the body.

The prevalence of obesity is rising in developed and developing nations, and it is cited as an important risk factor for early mortality (WHO, 1998). Obesity has a strong relationship

with cardiovascular diseases like hypertension (Stevens et al, 1998; Despres, 2001; Cameron et al, 2003), coronary heart disease and diabetes. A number of clinical measurements for obesity have been used to determine susceptibility to cardiovascular diseases (Cameron et al, 2003). These include anthropometric indices such as body mass index (BMI), waist-hip ratio (WHR) and waist circumference (WC) (Bray & Gray, 1988; Flier & Flier, 2005).

In this study, the mean values of body mass index (BMI) and waist-hip ratio (WHR) for female (BMI value=22.18 and WHR value =0.80) participants fall within the normal range and classified as average fat under World Health Organisation (WHO) norms. In addition, the result of the study showed that body mass index (BMI) has significant correlation with systolic blood pressure and diastolic blood pressure and strong independent indicator of blood pressure. However, waist-hip ratio is not found in significant relationship with systolic and diastolic blood pressure, and this study is partially in accordance with Canoy et al (2004); Dowling and Pi-Sunyer, (1993);Nesto, (2003); Flier and Flier (2005) where they found BMI and WHR, correlated significantly with systolic and diastolic blood pressures. Finally, regression equation is being developed in order to predict the systolic blood pressure and diastolic blood pressure.

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