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Central obesity is a better predictor for cardiovascular risk covariates among the adult Bengalee male

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ABSTRACT:

Aim & Objective: *The study intends to find out the relation between blood pressure and body composition indicators among the adult Bengalee male of North 24 Parganas, West Bengal, India.*

Material & Methods: *A cross sectional study has been conducted among 233 Bengalee male (aged 18 – 60 years) in four villages of North 24 Parganas. Area was selected by the deliberate sampling method whereas, populations were selected through random sampling method. Some anthropometric measurements, skinfold measurements and blood pressure were collected through standard techniques and Mean Arterial Pressure (MAP) was calculated. The calculated Body Composition Indicators (BCIs) were Body Mass Index (BMI), Waist Hip Ratio (WHR), Waist Height Ratio (WHtR), Percentage of Body Fat (PBF), Fat Mass (FM), Fat Free Mass (FFM).*

Results & Discussion: *There is a significant and positive correlation is present between blood pressures and all the anthropometric variables, except body height. In case of BCIs a significant positive correlation is present between obesity indicators and blood pressures. Step-wise multiple regression coefficient suggests that Waist circumference (WC) and Waist Height ratio (WHtR) are important predictors for assessment of hypertension or high blood pressure. Both WC and WHtR indicate central obesity of a person. The result suggests that central obesity is associated with increasing blood pressure and central obesity is the better indicator for the assessment of hypertension or high blood pressure among the adult Bengalee male population.*

Keywords: *Blood pressure, Obesity, Body composition indicators, Mean arterial pressure,*

INTRODUCTION:

In last few decades, it is found from the most of the study that obesity has increased substantially among the adult of developed and developing countries. Obesity at this age associated with so many physical abnormalities, including elevated blood pressures (Rubin, 2007). Blood pressure which is one of the important metabolic system by which transport materials around the body mainly oxygen and food substances to the body cells and remove their waste product such as carbon dioxide to keep them alive and well, without pressure it not be possible (Clegg & Mackean, 1999)

It is well established fact that, elevated blood pressure alone is not an illness or disease rather it is a risk marker for illnesses, which affects on three major organs of the body, heart, kidney and brain (Rubin, 2007). Hypertension or high bold pressure is an antecedent of heart disease and stroke, both leading causes of morbidity and mortality and its global importance is recognized, particularly in the context of increasing obesity mortality from cardiovascular disease in adults (Bell *et al.* 2002). In various epidemiological studies it has been found that excess body fat has been linked with cardiovascular disease and other chronic diseases and weight reduction is commonly associated with a decrease in blood pressure (Fahey *et al*, 2004).

Over the last 50 years, more than 300 risk factors have been correlated to the occurrence of coronary heart disease and stroke, although most of them are of uncertain causal relevance (Mackay & Mensah, 2004). In addition to the known non-modifiable risk factors, such as age and family history of cardiovascular disease epidemiological and other studies have identified a range of modifiable cardiovascular risk factors, including smoking, diabetes, and elevated blood pressure and cholesterol levels (Parish *et al*, 1995).

Hypertension affects more than a quarter of the world's adult population and this proportion is likely to reach 29% by 2025. Most of this increase will occur in developing countries. Obesity is reaching epidemic proportions in the industrialized world and contributes to morbidity and mortality. Although obesity is less prevalent in developed countries, it is increasing with urbanization. (Cappuccio *et al*, 2008). In India average age of heart patients is 52 years which is very earlier compare to the America, average 70 years (Iyer, 2014).

Blood pressure is not a static pressure it varies throughout the day. Mainly 'essential or primary hypertension' is very commonly found among the population, but still a lot of uncertainty about the causes of high blood pressure, over 95% of an underlying cause is not found, obesity is one of the major factors. In most of the cases several interrelated factors contribute to high blood pressure (Fahey *et al*, 2004). Different techniques are now available for measuring obesity, anthropometric measurements are one of the popular and universally accepted method. It is clear that obese individuals have more low density lipoprotein (LDL) which obstruct blood flow and increase blood pressure (Clegg & McKean, 1999).

There are so many body composition indicators (BCIs) are available by which a researcher can measure obesity through the help of some anthropometric measurements. Few previous studies determined that blood pressure have been based on some measures of body composition indicators that allow a separation of total body mass into lean body mass and total body fat. Consequently, the possible effects of these two factors on blood pressure have not been separated (Siervogel *et al,* 1982).

The present study intends to find out the association between blood pressure and body composition indicators which indicates obesity, in addition to identify the better predictors of BCIs for determine the blood plod pressure among the adult Bengalee male population.

MATERIAL AND METHODS:

Sampling

A cross-sectional survey was conducted in February to May 2013 on adult Bengalee male, aged between 18 to 60 years. Total 232 samples were collected from the area of Habra block I and II. Area was selected by the deliberate sampling technique and the samples were selected by random sampling technique. In this study all the participants were selected through their mother tongue (Bengali) and they almost belongs to same subsistence pattern for at least two generations.

Blood pressure measurement

Blood pressure (mmHg) were measured after obtaining oral consent under standardized conditions using an error free accurate mercury sphygmomanometer and a stethoscope. The blood pressure was measured at morning, specifically after breakfast. In order to record the blood pressure, participants were seated for at least 5 minutes in a chair with their backs supported and their arms bared and supported at heart level. Measurements (on nearest ±1.0 mmHg) were taken three times, at 5 minutes time interval and mean values were calculated for analysis. Hypertension was defined as SBP ≥140 mmHg and/or DBP ≥90 mmHg as per

European Society of Hypertension and the European Society guideline (ESH/ESC, 2003). The mean arterial pressure was obtained by applying the following simple equation $\text{Mean Arterial Pressure} = \text{Diastolic Pressure} + (\frac{1}{3} \times \text{Pulse Presure})$, $\text{Pulse Pressure} = (\text{Systolic Blood Pressure} - \text{Diastolic Blood Pressure})$ (Pocock & Richards, 2009).

Anthropometric measurement

Eight numbers of anthropometric measurements were collected from the studied participants on the basis of ISAK (2011) international standards guideline for anthropometric assessment (Stewart *et al.* 2011). Basic measurements were body mass or body weight (in kg.) measured by reliable weighing machine (on nearest ±0.1 kg.) and stature (in cm.) measured by anthropometer (on nearest ±0.1 cm.). Four skinfold measurements (in mm.) ware measured by reliable Harpenden skinfold caliper (on nearest ±0.1 mm.) viz. biceps, triceps, subscapular, Suprailiac. Two circumferences were taken viz. waist (in cm.) and hip circumference (in cm.), measured by inelastic tape (on nearest ±0.1 cm.). All these measurements were taken after obtaining oral consent and maintaining rules and regulation of standard protocol for collecting anthropometric measurements (Stewart *et al.* 2011).

Different body composition indicators were calculated as per using of internationally accepted formulas. Body mass index (BMI) was calculated as, weight in kilogram divided by height in meter squire (kg/m^2). Percentage of body fat (%fat) was calculated as [(4.95/Body Density) – 4.5] × 100, Body Density calculated as 1.1610 – 0.0632 Log∑4 [where ∑4 = ∑4 skinfolds; biceps, triceps, subscapular, suprailiac]. Fat Mass (FM, kg) calculated as (%fat/100) × Body weight (kg) and Fat Free Mass (FFM, kg) calculated as {Body Weight (kg) – Fat Mass (kg)} (Eston & Relly, 2009). Regional fat distribution was assessed by calculating the Waist Hip ratio (WHR) and the Waist Height ratio (WHtR).

Statistical Analysis

Collected Data were analyzed by the use of SPSS (version 16.0) statistical software package. For descriptive statistical analysis mean, standard division and percentile were calculated. Correlation coefficient and stepwise multiple regression coefficient are used as inferential statistical analysis, this analysis try to determine the relations of blood pressure with anthropometric indicators and BCIs. Stepwise multiple regression coefficients was done on the Z-score of each variables because Z value reduces the error of unites.

RESULTS AND DISCUSSION:

Results part is included both descriptive statistics and inferential statistics, inferential statistics have two more division first part is the relation between anthropometric variables and blood pressures, second part is the relation between BCIs and blood pressures. All data are expressed as mean and ±SD. Mean age of the population is 33.11 (±13.13). Mean blood pressures obtained as SBP 119.63 (±13.11), DBP 78.32 (±10.18), and MAP 92.11 (±10.27).

Table 1A: Correlation between blood pressures and anthropometric indicators

Anthropometric variables	Mean (±SD)	SBP	DBP	MAP
Stature (cm.)	163.08 (±5.60)	0.016	0.074	0.056
Body Mass (Kg.)	57.37 (±9.31)	0.382**	0.372**	0.408**
Waist circumference (cm.)	77.35 (±9.70)	0.426**	0.401**	0.446**
Hip circumference (cm.)	84.81 (±6.15)	0.340**	0.323**	0.358**
Biceps SF. (mm.)	5.76 (±2.88)	0.292**	0.225**	0.273**
Triceps SF. (mm.)	8.72 (±4.26)	0.215**	0.219**	0.236**
Subscapular SF. (mm.)	14.94 (±6.68)	0.306**	0.307**	0.333**
Suprailiac SF. (mm.)	17.60 (±8.42)	0.303**	0.276**	0.311**

**Significant, p<0.01

Table 1B: Multiple regression (stepwise) between blood pressures as dependent and anthropometric variables as independent variables

Dependent variables	B	R^2change	t value	p value
SBP	0.426	0.182	7.147	0.0001
DBP	0.401	0.161	6.632	0.0001
MAP	0.446	0.199	7.555	0.0001

Predictors Waist circumference

Table 1A and 1B are the first part of the result, here mainly discussed about the relationship between blood pressures and anthropometric variables. Pearson correlation coefficient between blood pressure and anthropometric variables (Table 1A) reveals that except body stature all anthropometric measurements are positively correlated with SBP, DBP and MAP and it is highly significant ($p<0.01$). Waist circumference (WC) showing highest correlation with blood pressures and this WC indicates central obesity of a person.

The result of multiple regression coefficient (stepwise) are summarized in Table 1B, which includes three multiple regression coefficient compactly. Here, all the anthropometric variables are selected as independent variables and separately SBP, DBP, MAP selected as dependent variables. Beta (β) value refers to that among the all independent variables only WC significantly ($p<0.0001$) predicts on SBP, DBP and MAP. Based on R^2 change value it is clear that WC have a significant positive effect on blood pressure. The model predicted that the percentage of variance (R^2) is for SBP, DBP and MAP with independent variables are 18%, 16% and 19% respectively.

Table 2A: Correlation between blood pressures and body composition indicators

BCIs	Mean (SD)	SBP	DBP	MAP
BMI (kg/m^2)	21.56 (±3.23)	0.400**	0.368**	0.413**
Waist Hip ratio	0.910 (±0.072)	0.362**	0.340**	0.378**
Waist Height ratio	0.475 (±0.060)	0.416**	0.376**	0.425**
Percentage body fat	18.02 (±5.20)	0.326**	0.309**	0.343**
Fat mass	10.71 (±4.55)	0.367**	0.345**	0.384**
Fat free mass	46.66 (±5.52)	0.341**	0.343**	0.371**

**Significant, p<0.01

Table 2B: Multiple regression (stepwise) between blood pressures as dependent and BCIs as independent variables

Dependent variables	B	R^2change	t value	p value
SBP	0.416	0.173	6.933	0.0001
DBP	0.376	0.142	6.158	0.0001
MAP	0.425	0.181	7.126	0.0001

Predictors WHtR as Independent variables

The last part of the result included table 2A and 2B, here mainly discussed about the relationship between blood pressures and BCIs. Table 2A estimates that, the Pearson correlation coefficient of blood pressure with BCIs. Here it is clearly found that all BCIs are significantly ($p<0.01$) and positively associated with blood pressures. WHtR is showing the maximum correlation with blood pressures.

Table 2B is showing the result of multiple regression coefficients (stepwise), which includes three multiple regression coefficient compactly. Here, all the BCIs are selected as independent variables and separately SBP, DBP, MAP selected as dependent variables. Beta (β) value refers to that among the all independent variables only WHtR significantly ($p<0.0001$) predicts on SBP, DBP and MAP. Based on R^2 change value it is clear that WHtR have a significant positive effect on blood pressure. The model predicted that the percentage of variance (R^2) is for SBP, DBP and MAP with independent variables are 17%, 14% and 18% respectively.

Figure 1: Comparetive distribution of Mean Arterial Pressure and Waist circumference

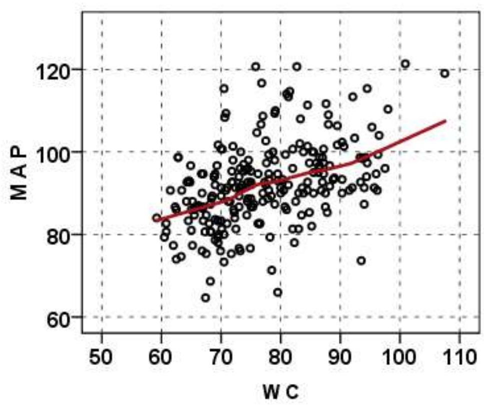
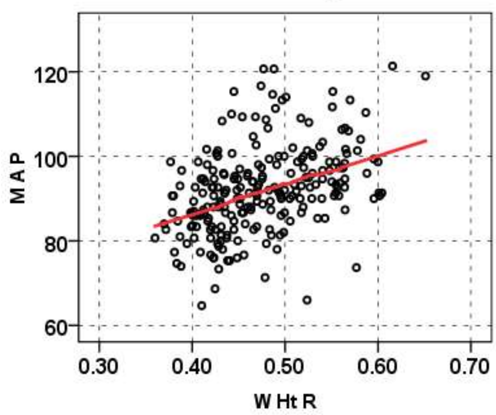


Figure 2: Comparetive distribution of Mean Arterial Pressure and Waist Height Ratio



Correlation of blood pressures with waist circumferences and waist height ratio are present in figure 1 and 2 respectively. Here, MAP used for the assessment of blood pressures, because MAP is a better indicator for analytical interpretation as compare to SBP and DBP separately as it yields different results. Both figures depict the scattered plot which contains a Loess-Gaussian curve (Confidence intervals 95%). Figure 1 shows same trends, where WC affected MAP positively and it is clearly indicates by the curve. More or less same trends found in case of figure 2, where the curve is represented by WHtR. MAP increases with the increment of WC and WHtR.

CONCLUSIONS:

Cardiovascular disease is one of the most important problems affecting the community health and is a burden on health economy. Better understanding of the risk factors has been the top priority. Obesity being one of the commonest risk factors of chronic Non Communicable Diseases like Hypertension; it is generally measured in terms of different anthropometric indicators. This could be attributed to central obesity or regional fat distribution which needs other measures like, Waist Circumference and Waist Height Ratio.

The present study examines the relationship between blood pressure and different body composition indicators; most of these BCIs (except FFM) mainly indicate the body fat distribution of a person. Blood pressure is a multifactorial trait, genetic and environmental both factors are responsible for the expression of blood pressure. In this study only one factor (obesity) is included. The results indicate that obesity play a vital role for the expression of blood pressure in the studied Bengalee peoples. On the other hand, obesity is also a multifactorial trait therefore people can control their body weight or nutritional status through the control of nutrition (food consumption) or physical exercise etc.

However, the most striking finding is that blood pressures have a positive effect of body fat, but this association is not very strong, except WC and WHtR in the studied population. Even WC and WHtR significantly predict all types of blood pressures. Both the indicators are mainly indicating the central obesity of a person. Waist circumference directly indicates the central obesity on the other hand WHtR indicates the relative central obesity of a person compare to his or her lean body height. This study suggests that central obesity always associated with increasing of blood pressures and Waist Height ratio (WHtR) is better body composition indicator for the assessment of hypertension or high blood pressure among adult Bengalee male population.

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