Effect of Obesity on Blood Pressure among the Young Adult Bengalee Hindus of Madhyamgram, North 24 Parganas, West Bengal

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ABSTRACT: The present study intends to find out the relationship between blood pressure and obesity as well as the effect of obesity on blood pressure among the Bangalee Hindu young adults. Data were collected from the age-group of 20 to 30 years among 250 male and 250 female Bengalee Hindus from North 24 Parganas. Body mass index (BMI), Waist hip ratio (WHR) and Waist height ratio (WHtR) were calculated as body composition indicators (BCIs) for obesity measurement as well as Mean Arterial Pressure (MAP) was calculated from Systolic (SBP) and Diastolic blood pressure (DBP). A significant ($p<0.01$) and positive correlation is present between blood pressure (SBP, DBP and MAP) and BCIs (BMI, WHR and WHtR). Step-wise multiple regression coefficient suggests that Body Mass and BMI are significant ($p<0.0001$) predictors for assessment of high blood pressure. The result suggests that total body obesity is associated with increasing blood pressure rather than regional fat distribution.

INTRODUCTION

Health, it is not just a biological term; rather it is the primary priority of all living life. World Health Organization (WHO) defined health of a person, as a "state of complete physical, mental and social well-being and not merely the absence of disease or sickness" (WHO,'48). In past few decades health has become more important issue among the young adults because it is the age of rush and harsh life style, ambiguous social and mental network and also for the tendency to follow the modern trend blindly. One of the major factors that have a great sway on the health of young adults is obesity (Lahti-Koski *et al*., 2002).

From the recent past, many studies have been done on obesity, which shows that the rate of obesity has been increased rapidly among the young-adult population of both developed and developing countries (Bhurosy and Jeewon, 2014). Some current evidences indicate that obesity is a multifactorial condition influenced by many factors like, biological factors which include genetic abnormalities as well as cultural factors which includes food habit, economic condition, and daily activities (Maiti *et al*., 2013). Obesity among the young adults is also associated with a number of physical unwellness, such as high blood pressure (clinically known as hypertension), which is another vital health problem among the adult population.

Obesity is a medical condition in which excess body fat has assembled to the amplitude that it may

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have negative effect on health (Khatib and El-Guindy, 2005). General obesity is quite natural in recent times, and the prevalence of obesity is higher among the women in Indian subcontinent and the modern lifestyle in the environment which influence obesity is the leading cause of increasing weight (Maiti *et al*., 2013). The most common cause of obesity is the coalescence of exorbitant food intake, more energy-opaque food intake, lack of any kind of physical activity and genetic perceptivity.

Blood pressure is a force that is circulating blood within the blood vessels, which transport materials around the body to the cell and remove the waste products in order to keep them alive and well (Clegg and Mackean,'99). It has been very recently observed that the prevalence of hypertension is directly related to the deposition of low density lipoprotein (LDL) in the wall of arteries, which obstruct blood flow and increase blood pressure. For this matter deposition of adiposity or extra body fat is associated with the increase of blood pressure. High blood pressure or hypertension is a precursor of heart disease and stroke, which are leading causes of morbidity and mortality (Sarkar *et al*., 2009). Both obesity and hypertension becomes an important public health challenge among the young adult population.

There are different body composition indicators (BCIs) present which can help in estimating the obesity of a person. Lot of studies indicate that body mass index (BMI), Waist-hip ratio (WHR) and waist-height ratio (WHtR) are very essential BCIs for the estimation of the effect of obesity on blood pressure. These BCIs are very easily determined by a researcher with the help of anthropometric variables (Kundu *et al*., 2017). However, anthropometric variables and BCIs both can indicate obesity and the possible effects of these two factors on blood pressure have not been separated (Siervogel *et al.*,'82).

The present study intends to find out the relation between blood pressure and different anthropometric variables, which generally indicate obesity as well as the relation between BCIs and blood pressure, among the young-adult Bengalee Hindus of both sexes of North 24 Parganas district of West Bengal, India. An additional objective is identification of the most effective components from anthropometric variables and BCIs, which may have significant effect on blood pressure of the studied population. A young adult is generally a person ranging in age from their late teens or early twenties to their thirties although definitions and opinions vary in stages of human development (*https://en.m.wikipedia.org/wiki/Young_adult_psychology*).

MATERIALS AND METHODS

Sampling: A cross-sectional study was conducted during the first half of the year 2017 on young adult (Petry, 2002) Bengalee male and female (20-30 years) of Madhyamgram Municipal Area of North 24 Parganas district, West Bengal. Total 500 research samples were selected from Kolkata and surrounding areas of the district of North 24 Parganas, of which 250 were males and 250 were females. In this study, the area was selected by the purposive sampling and all the research samples were selected through random sampling technique by using the appropriate statistical method. Research samples were characterized by mother tongue Bengali, with religion Hinduism (not converted to Hinduism from other religions), as well as they belongs to same subsistence pattern for at least two generations.

Data collection: Schedule was prepared for collecting the data from the research partners, which contained age, sex, religion, mother tongue, anthropometric measurements and blood pressure. Data were collected after obtaining the verbal consent of the volunteered sample and all the standard methods were followed for collecting the following anthropometric measurements.

Anthropometric measurements: Total four anthropometric measurements were taken on the individual sample, totaling 500 samples, for this research study on the basis of ISAK guidelines (Stewart *et al*., 2011). The measurements are: (i) body stature (in cm) measured by anthropometer (on nearest ±0.1 cm), (ii) body mass or weight (in kg), was measured by a reliable weighing machine (on nearest ±0.1 kg), (iii) waist and (iv) hip circumference (in cm) were measured by inelastic tape (on nearest ±0.1 cm).

Body composition indicators: Body composition indicators (BCIs) were calculated on the basis of standard formula. Body mass index (BMI) was calculated as weight in kilogram divided by height (stature) in meter square (kg/m^2). Regional fat distribution was estimated on the basis of calculating the Waist Hip ratio (WHR) and the Waist Height ratio (WHtR).

Blood pressure measurement: Blood pressure (in mmHg) were measured by using an error free mercury sphygmomanometer and a stethoscope. The blood pressure was measured at morning, specifically minimum 30 minute after breakfast. To record the blood pressure, the participants were seated in a chair with back supported, feet on the floor and legs uncrossed. The lower edge of the blood pressure cuff was tightened 1 inch above the bend elbow. The measurements (on nearest ±1.0 mmHg) were taken three times at a 10 minute time interval for the accuracy and then the mean value was obtained, which considered as actual blood pressure value. Mean Arterial Pressure (MAP) was calculated by using the following equation MAP = DBP + {1/3(PP)}, where PP (Pulse Pressure) = (SBP - DBP), SBP = Systolic blood pressure, DBP = Diastolic blood pressure (Pocock and Richards, 2009).

Statistical analysis: Collected data were analyzed by using Statistical Package for the Social Science (SPSS, version 18.0). Mean and Standard deviation (±SD) were calculated for the analysis of descriptive statistics and for the inferential analysis correlation coefficient and stepwise multiple regressions were used. All these statistical analysis tries to understand the relation between anthropometric variables and blood pressure.

RESULTS & DISCUSSION

Descriptive statistics of the present study of the research sample show the following overviews; all data are expressed as mean (±SD). For male and female samples mean SBP obtained was 122.52(±7.50) and 122.37(±6.79) respectively; DBP obtained was 75.24(±6.55) and 77.78(±4.64) respectively; and MAP obtained was 91.00(±6.05) and 92.64(±4.75) respectively.

TABLE 1a

Correlation between anthropometric variables and blood pressure in the males of the study area

Anthropometric variables	Mean (±SD)	SBP	DBP	MAP
Stature (cm)	167.53(±5.07)	- 0.148*	0.023	- 0.045
Body mass (kg)	70.84(±11.22)	0.564**	0.554**	0.632**
Waist circumference (cm)	81.14(±7.33)	0.418**	0.430**	0.483**
Hip circumference (cm)	92.91(±5.15)	0.053	0.079	0.078

**Significant, p<0.01; *Significant, p<0.05

TABLE 1b

Correlation between anthropometric variables and blood pressure in the females of the study area

Anthropometric variables	Mean (±SD)	SBP	DBP	MAP
Stature(cm)	155.54(±5.56)	0.096	0.059	0.084
Body Mass (kg)	61.08(±12.43)	0.735**	0.523**	0.690**
Waist Circumference (cm)	80.74(±1.15)	0.698**	0.522**	0.672**
Hip Circumference (cm)	96.29(±9.24)	0.565**	0.437**	0.553**

**Significant, p<0.01

Table 1a and Table 1b show the results of correlation between blood pressure and the anthropometric variables considered for the present study for male and female samples. Both the tables reveled that there is significant (p<0.01) positive correlation between blood pressure and anthropometric variables among male and female participants of the studied population. In the case of the correlation between stature and blood pressure (SBP, MAP) among the males, the result shows a negative correlation, and the correlation is also significant (p<0.05) between SBP and stature. Though, stature does not show any correlation but body mass shows the highest correlation with the blood pressure in case of both male and female study samples. It is also found from both tables that the correlation values of SBP and DBP are not same in respect of different anthropometric variables, for this matter MAP taken into consideration.

TABLE 2a

Stepwise multiple regression between anthropometric variables and blood pressure in the male sample

Dependent variables	β -value	R^2 change	t-value	p-value
SBP	0.564	0.318	10.755	0.0001
DBP	0.554	0.306	10.466	0.0001
MAP	0.632	0.399	12.835	0.0001

Predictor body mass as independent variable

TABLE 2b

Stepwise multiple regression between anthropometric variables and blood pressure in female sample

Dependent variables	β -value	R^2 change	t-value	p-value
SBP	0.735	0.540	17.068	0.0001
DBP	0.523	0.273	9.654	0.0001
MAP	0.690	0.476	15.024	0.0001

Predictor body mass as independent variable

The results of stepwise multiple regression coefficient are presented in Table 2a and 2b for male and female samples respectively, which includes three stepwise multiple regression coefficient compactly. In this case, all the anthropometric variables are selected as independent variables and SBP, DBP and MAP are selected consistently as dependent variables. Beta value (β) refers that from all the independent variables only body mass significantly ($p<0.0001$) predicts on SBP, DBP and MAP among both sexes of young adults. On the basis of R^2 change, the model predict that percentage of (R^2) is for SBP, DBP and MAP in respect of body mass as independent variables are 32%, 31%, 40% respectively for male participants (Table 2a) and 54%, 27%, 48% respectively for female participants (Table 2b).

TABLE 3a

Correlation between body composition indicators and blood pressure in the male sample of the study area

Body composition indicators	Mean (±SD)	SBP	DBP	MAP
BMI(kg/m2)	25.20(±3.71)	0.679**	0.586**	0.703**
Waist hip ratio	0.87(±0.53)	0.573**	0.567**	0.645**
Waist height ratio	0.48(±.04)	0.451**	0.403**	0.476**

**Significant, $p<0.01$

TABLE 3b

Correlation between body composition indicators and blood pressure in the female sample of the study area

Body composition indicators	Mean (±SD)	SBP	DBP	MAP
BMI(kg/m2)	25.15(±4.50)	0.794**	0.569**	0.748**
Waist hip ratio	0.83(±0.05)	0.649**	0.467**	0.613**
Waist height ratio	0.51(±0.07)	0.699**	0.527**	0.676**

**Significant, $p<0.01$

The last half of the result includes the relation between body composition indicators and blood pressure. Table 3a and Table 3b consist of the correlation between body composition indicators and blood pressure of males and females of the sample studied. The result reveled that all BCIs are positively and significantly ($p<0.01$) correlated with blood pressures in case of both male and female participants. Body mass index (BMI) is showing the highest correlation with blood pressure among both the sexes. It is also found from the tables 3a and 3b that the correlation values of SBP and DBP are not same in respect of different BCIs, for this matter MAP was taken into consideration.

TABLE 4a

Stepwise multiple regression between body composition indicators and blood pressure in the male sample

Dependent variables	β -value	R^2 change	t-value	p-value
SBP	0.679	0.461	14.556	0.0001
DBP	0.586	0.344	11.402	0.0001
MAP	0.703	0.494	15.562	0.0001

Predictor BMI as Independent variable

TABLE 4b

Stepwise multiple regression between body composition indicators and blood pressure in the female sample

Dependent variables	β -value	R^2 change	t-value	p-value
SBP	0.794	0.630	20.548	0.0001
DBP	0.569	0.324	10.895	0.0001
MAP	0.748	0.560	17.771	0.0001

Predictor BMI as Independent variable

The result of stepwise multiple regression coefficient are present in Table 4a and 4b among males and females respectively, which includes three stepwise multiple regression coefficient compactly. All the body composition indicators are selected as independent variables and separately SBP, DBP and MAP are selected as dependent variables. Beta value (β) refers that among all independent variables only BMI significantly ($p<0.0001$) predicts on SBP, DBP and MAP. R^2 change refers that, the model predict that percentage of (R^2) is for SBP, DBP and MAP in respect of BMI as independent variables are 46%, 34%, 49% respectively for male participants (table 4A) and 63%, 32%, 56% respectively for female participants (Table 4b).

CONCLUSION

Hypertension is one of the major challenging health issues for the developing countries because this global burden of non-communicable disease is increasing dramatically in this particular region. Hypertension or high blood pressure is basically a multifactorial trait; numerous factors are responsible for the rising of hypertension, under two major umbrella biological factors and environmental factors. It is very difficult to treat any genetic problems which are responsible for hypertension, while any type of environmental problem should be easily curable. The environmental problem basically includes our lifestyle patterns such as, more calorie related food intake, very less physical activities and so on. However, these factors directly do not affect blood pressure rather these factors cumulatively creates obesity, and obesity affects blood pressure.

Obesity rapidly increases among most age-groups of both sexes. The young adult group of people is also affected as this age-group is very unstable for various social, mental, and physiological pressures. Thus obesity is found to affect on blood pressures among young adult people. The present study was carried out in two steps – the first step includes the relationship between blood pressure and some relevant anthropometric variables which indicate obesity; and the second step includes the relationship between blood pressure and body composition indicators which are also considered as the determining factors for obesity.

It is observed from the study that among the male participants, body mass and waist circumference are positively and significantly correlated with blood pressures; however, correlation value is higher in body mass or body weight. Almost similar results are found among the female participants; body mass, waist and hip circumferences were positively and significantly correlated with blood pressures, but correlation value is higher in body mass. Stepwise regression coefficients clearly identify body mass as a predictor for blood pressures among the both sexes of the studied participants. Correlation between blood pressures and all body composition indicators are positively and significantly correlated, but the correlation value is higher in BMI of both sexes. Stepwise multiple regression coefficient shows, BMI is the significant predictor for blood pressure among young Bengalee Hindu adults. The most striking finding is that, among the young adult of urban Bengalee Hindus, hypertension or high blood pressure are mainly affected by the total body obesity rather than regional fat distribution, because waist and hip circumference as well as WHR and WHtR are not showing any significant relation in stepwise multiple regression with blood pressures. However, this study suggests that, obesity is not a static physiological condition. If any individual maintain low body fat and normal BMI level then he or she can control their blood pressures.

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