ORIGINAL ARTICLE

COMPARATIVE STUDY OF ANTHROPOMETRIC MEASUREMENTS & LIPID PROFILE IN CARDIOVASCULAR DISEASE RISK FACTORS

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ABSTRACT: BACKGROUND: Obesity is now a global epidemic called as “globesity”. Diabetes mellitus, hypertension is the important cardiovascular disease risk factors that are associated with obesity. Cardiovascular risk is counted partly by metabolic alterations associated with abdominal obesity, disturbances in plasma glucose homeostasis and lipoprotein metabolism. AIM: To determine the level risk of coronary artery disease (CAD) in the study group depending on waist circumference (WC) & Body mass index (BMI). Secondly, to compare the anthropometric measurements and lipid profile in the three groups. MATERIALS & METHODS: Study comprised of three groups: group I (n=30) type II diabetes mellitus, group II (n=30) primary essential hypertension, group III (n=30) hypertensive diabetics. WC, Weight & Height were measured. Lipid profile was estimated. Blood pressure was recorded. Statistical analysis was done by SPSS.

RESULTS: The Mean & Standard Deviations (SD) values for WC & BMI in Group I were seen to be highest in group II 88.1±15.06 & 28.69±4.7 respectively. Statistically significant difference seen in systolic blood pressure between three groups with F value of 18.29 & p value of <0.001. Diastolic blood pressure also showed statistically significant difference in the three groups with F value 21.92 of & p value of < 0.001. statistically significant difference in HDL levels with p value of <0.05, serum cholesterol/ HDL ratio with p value of <0.05 and highly significant difference in triglyceride levels between three groups with p value of <0.001. Conclusion: Waist circumference is a better anthropometric marker as compared to BMI to assess the CAD risk. All the three groups had risk of CAD, but Hypertensive diabetics had highest predisposition for CAD.

KEYWORDS: Obesity CAD risk waist circumference BMI blood pressure lipid profile.

INTRODUCTION: Obesity is a complex condition having serious social and psychological aspects that affects almost all age and socioeconomic groups. It is an increasing problem in both developed as well as developing countries. This global epidemic of overweight and obesity termed “globesity” is increasing in many parts of the world.¹ Obesity is a condition that develops because of excess deposition of adipose tissue in the body. It has direct relationship with the development of type II diabetes mellitus and hypertension which in turn are among major risk factors for development of coronary artery disease.²

The excess deposition of adipose tissue is usually estimated using skin fold thickness. But, the distribution of fat varies according to the anatomical location. The body fat distribution is considered as an important variable in the association between obesity and cardiovascular disease. Abdominal fat accumulation as compared to peripheral fat accumulation shows greater metabolic complications.
Furthermore, it has been seen that omental fat depot is critical in association between the level of abdominal fat and cardiovascular disease risk factors as this deposition of fat is associated with metabolic complications.

Computerized Axial Tomography (CAT) is a reliable technique for the measurement of adipose tissue distribution, particularly deep fat depots. However, with CAT there is irradiation risk and it is not cost effective so not widely used. Thus, the development of anthropometric measurements to predict amount of deep abdominal fat deposition is important. Overweight, obesity & abdominal fat deposition are associated with increased morbidity and mortality from cardiovascular diseases. Cardiovascular risk is counted partly by metabolic alterations associated with abdominal obesity, disturbances in plasma glucose homeostasis and lipoprotein metabolism, which are risk factors for atherosclerosis are seen in excessive deposition of adipose tissue at abdominal level. Simple clinical anthropometric measurements, such as waist circumference (WC), waist-to-hip ratio (WHR) and body mass index (BMI) can be easily used to assess regional adiposity as some of these surrogate markers correlate reasonably well with laboratory based measures of adiposity using MRI or CT.

From clinical point of view, estimation of regional adipose tissue distribution must therefore be considered as important in the evaluation of patients cardiovascular risk profile. Waist circumference, Waist-hip-ratio and BMI are simple anthropometric measurements which can be used in clinical practice.

MATERIALS & METHODS: A Crosssectional, hospital based study comprising of, group I (n=30) type II diabetes mellitus, group II (n=30) primary essential hypertension, group III (n=30) hypertensive diabetics.

This hospital based study was conducted in 2008 after approval by the institutional ethical committee.

The study population included male patients coming to the medical outpatient department. Subjects were living mostly in and around the hospital area belonging mainly to middle & lower middle class urban family.

The protocol was explained to the subjects and written informed consent was obtained. A proforma form was also given to all the subjects wherein details about type of diet, smoking/alcohol, type of physical activity, history of any medical illness, past medical history, family history etc. was obtained.

The known diagnosed cases of type II diabetes mellitus, primary essential hypertension and hypertensive diabetics on regular medical treatment, with history of duration of disease from 1-5yrs, having mixed diet, non-smoker, non-alcoholic with moderate physical activity and belonging to age group 40-50yrs were included in the study. A detailed general and physical examination was conducted and subjects with history of smoking/alcohol, other acute or chronic medical illness and type I diabetes mellitus were excluded. Patient with previous history of cardiovascular event or stroke were excluded from the study. Subjects reported with 12hrs fasting, anthropometric measurements were obtained. Weight (kg) was measured using standard calibrated balance scale, after removal of shoes and wearing light clothing. Height (cm) was obtained using stadiometer and BMI was calculated using Quetlet’s index. Waist circumference
(WC) was measured (cm) halfway between the lower border of ribs and the iliac crest in the horizontal plane. Blood pressure was recorded using mercury sphygmomanometer five minutes after rest in sitting position with the arm and back supported. Venous blood was collected in sitting posture for estimating lipid profile. For estimating Serum cholesterol and High Density Lipoprotein (HDL)- cholesterol CE-CO-PAP enzymatic method was used and for triglyceride levels(TG’s) GPO-PAP enzymatic methods were used. Serum cholesterol/HDL ratio was calculated. In the present study, the cut-off values for anthropometric measurements and the associated risk of coronary artery disease are taken as per WHO guidelines.  

| Classification   | CAD Risk | BMI Score |
|------------------|----------|-----------|
| Underweight      | Moderate | <18.5     |
| Normal           | Very low | 18.5-24.9 |
| Overweight       | Low      | 25-29.9   |
| Obese Class I    | Moderate | 30.0-34.9 |
| Obese class II   | High     | 35.0-39.9 |
| Extreme obesity  | Very high| >40       |

**Cut off values for waist circumference:**
- >85cms in males.
- >80cms in females.
- Suggest higher risk of coronary artery disease.
- Descriptive statistic is given between mean and standard deviation. Comparison of variables between groups was done by ANOVA using SPSS.

**RESULTS:** The mean & standard deviation of waist circumference, body mass index, Systolic and Diastolic blood pressure, lipid profile and the comparison between groups I, II & III is shown in Table No.1. No Statistically significant difference was seen in waist circumference (WC) and body mass index (BMI) between three groups. However, the mean & standard deviations values for WC & BMI were seen to be highest in group II i.e 88.1±15.06 & 28.69±4.7 respectively (Refer to figure 1 & 2). The coronary artery disease risk was seen to be higher in all the three groups, when the risk was assessed in terms of WC, particularly in group II the risk was highest. According to BMI the subjects in the three groups had low to moderate risk of CAD.

Referring again to Table No.1 & Figures 3. There was statistically significant difference seen in systolic blood pressure between three groups with F value of 18.29 & p value of < 0.001.Diastolic blood pressure also showed statistically significant difference in the three groups with F value 21.92 of & p value of < 0.001. Mean values for both systolic and diastolic blood pressure was found to be highest in group II as compared to group I & II.

Figures 4,5,6,7 shows the mean values for lipid profile. The serum cholesterol levels were found to be more in group II i.e 191.0±26.9 & Group III (184.4±31.6). The HDL levels in the three groups were, Group I (53.3±6.9), Group II
Thus, it was found to be lowest in Group III as compared to Groups I & II. Serum cholesterol/HDL ratio in Group I(3.59±0.66), Group II(4.01±0.56) & Group III(4.05±0.74) and the triglyceride levels were found to be highest in Group III (151.2±53.74), as compared to Group I(98.46±46.5), Group II(109.9±26.6). Referring to Table No.1, shows which shows statistically significant difference in HDL levels with p value of < 0.05, serum cholesterol/HDL ratio with p value of < 0.05 and highly significant difference in triglycerides levels between three groups with p value of<0.001.

![Fig. 1: Mean values of waist circumference in group I, group II & group III](image)

**Table No. 1: Blood pressure, anthropometric measurements, lipid profile of the male subjects in Groups I, II & III**

| Variable         | Group I (Diabetic) | Group II (Hypertensive) | Group III (Diabetic Hypertensive) | F value | P value |
|------------------|--------------------|-------------------------|----------------------------------|---------|---------|
| Systolic B.P     | 117.9±4.87         | 129.4±13.69             | 134.4±11.59                      | 18.29   | 2.328E-07** |
| Diastolic B.P    | 73.53±8.0          | 83.9±8.39               | 86.46±7.62                       | 21.92   | 1.941E-08** |
| WC               | 87.36±14.3         | 88.1±15.06              | 84.81±9.69                       | 0.5     | 0.6     |
| BMI              | 26.59±4.1          | 28.69±4.7               | 26.48±4.7                        | 2.26    | 0.11    |
| Sr. cholesterol  | 191.0±26.9         | 199±36.06               | 184.4±31.6                       | 1.8     | 0.17    |
| HDL              | 53.3±6.9           | 49.6±8.78               | 45.7±9.04                        | 6.37    | 0.002*  |
| Sr. cholesterol/HDL | 3.59±0.66      | 4.01±0.56               | 4.05±0.74                        | 4.46    | 0.01(P<0.05) |
| TG’s             | 98.46±46.5         | 109.9±26.6              | 151.2±53.74                      | 12.02   | 2.452E-05** |

P Value *<0.01, **<0.001.
Fig. 2: Mean values of Body Mass Index in group I, group II & group III

Fig. 3: Mean values of systolic & diastolic blood pressure in Group I, Group II & Group III
Fig. 4: Mean values of serum cholesterol in Group I, II, III

Fig. 5: Mean values of HDL cholesterol in Groups I, II, III
**DISCUSSION:** Overweight & obesity are important determinants of health and lead to adverse metabolic changes, including high blood pressure, unfavorable cholesterol levels, hypertriglyceridermia, low HDL levels, increased insulin resistance and greater prevalence of metabolic syndrome. They raise the risk of coronary heart disease, stroke, type II diabetes mellitus and many forms of cancer.
The present study showed significant prevalence of obesity & overweight in all the three groups. The data obtained from the present study shows blood pressure to be in the high normal range (pre-hypertension), particularly group III i.e., hypertensive diabetic group, although this group was on regular medication for hypertension. Thus, there is greater risk of CAD in this group. A fatal combination of hypertension and diabetes, which is a fact, owing to metabolic disturbances involved with these conditions. The Finding was similar to the hypertension diabetes study, 2003.\(^8\) The findings were consistent with studies done by Shahbazpour N et al,\(^9\) Assmann G et al.\(^10\) Bonorra E, et al,\(^11\) P R Deshmukh, et al,\(^12\) Stamler et al.\(^13\) The association between obesity & hypertension is well established. Both systolic & diastolic pressure increases with BMI and obese individuals have higher risk of developing hypertension than lean people. The possible reason behind this could be higher circulating levels of insulin (A consequence of insulin resistance) & consequently renal retention of sodium resulting in high blood pressure, elevated plasma rennin, and enhanced catecholamine activity. Obesity may cause increased cardiac output, greater red cell mass, increased red cell volume and or increased corticosteroid secretion. The data in our study also showed higher levels of triglycerides group III. Such alterations are usually associated with small dense LDL particles that are more atherogenic. Since they have lower affinity for LDL receptors, closer binding to arterial wall proteoglycans and higher susceptibility to oxidation, thus increase the CHD risk. Findings are similar to studies done by Haffner SM et al,\(^14\) Pallu Venkatramana et al,\(^15\) Mohan V\(^16\) et al.

In the present study, the individuals in group II were having higher risk of developing CAD, when WC was considered to assess the CAD risk. While, according to BMI group II had low risk of CAD. Most importantly in this particular study the diabetics, hypertensive and hypertensive diabetics were on regular medications in spite of that the blood pressure readings or the lipid profile showed values which were not absolutely normal. This could have been due to noncompliance of medication. Thus, measures to prevent any cardiovascular event in future were suggested. Advice was given regarding adoption of healthy lifestyle, regular and proper medication which can decrease the rate of progression of blood pressure in hypertensive patients. They were advised to reduce or maintain body weight & keep check on waist circumference. Importance of regular exercise and healthy balanced diet was explained to the study group.

**CONCLUSION:** Overweight & obese individuals were found to be present in all three groups. Waist circumference was a better anthropometric marker as compared to BMI to assess the CAD risk. Hypertensive diabetics had highest predisposition for CAD.

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