Original Research Article

A study of body fat distribution and cardiovascular risk factors in Government Dharmapuri Medical College, Dharmapuri

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International Archives of Integrated Medicine, Vol. 4, Issue 7, July, 2017.

Available online at http://iaimjournal.com/
ISSN: 2394-0026 (P) **ISSN: 2394-0034 (O)**

Received on: 06-07-2017 **Accepted on:** 14-07-2017
Source of support: Nil **Conflict of interest:** None declared.

How to cite this article: M. Selvaraj, G. Kannan. A study of body fat distribution and cardiovascular risk factors in Government Dharmapuri Medical College, Dharmapuri. IAIM, 2017; 4(7): 179-185.

Abstract

Introduction: Cardiovascular disease is the leading cause of death in global deaths and accounts for 17 million people worldwide. Despite the favorable changes in the risk factors, new risk factors have emerged. These include abdominal obesity and physical inactivity, both of which are considered independent and mediating factors in the development of cardiovascular disease. They are also associated with type 2 Diabetes and Metabolic syndrome, growing health hazards all over the world and the major risk factors for cardiovascular disease.

Aim of The Study: To determine the associations of Waist circumference and Waist Hip ratio with the risk of incident cardiovascular events and to determine the strength of association of waist and waist hip ratio with cardiovascular risk is different.

Materials and methods: A total of 98 cases (49 Cases and 49 Controls) were selected. Newly diagnosed consecutive cases of myocardial infarction admitted to the department to the department of cardiology were enrolled into the study after obtaining consent. These patients were subjected to anthropometric measurements namely waist hip ratio, weight height, skin fold thickness and Lipid profile was done.

Results: Both the groups were matched for age, sex and risk factors other than the one studied, namely smoking, alcoholism, diabetes, hypertension, family history. There was no statistical difference is noted between the two groups in age, sex, smoking, alcoholism, Hypertension, Diabetes, Family History. In all these parameters compared between these groups the P value was more than 0.05 which was statistically insignificant.

Conclusion: BMI does not properly define obesity and the risk of cardiovascular events. BMI can be normal in a patient with cardiovascular disease. Abdominal obesity is an independent risk factor for coronary heart disease. Waist hip ratio and waist circumference are better indicators of the cardiovascular risk in a given individual than BMI.

Key words

Abdominal obesity, Waist circumference, Coronary heart disease.

Introduction

Visceral fat accumulation may underlie the adverse metabolic profile associated with obesity [1]. Indeed Waist circumference and Waist Hip ratio as indicators of Abdominal obesity have been shown to be better than body mass index as an indicator of total adiposity for identifying individuals at higher risk of developing atherosclerotic diseases [2]. It is plausible that Body mass index may be less sensitive than Waist circumference or Waist Hip ratio at capturing the underlying and disparate metabolic effects of fat depots. Furthermore Waist and Hip circumferences have been shown to have separate and opposite cross sectional associations with metabolic factors [3]. The Obesity associated increased risk for developing cardiovascular disease could be due to the adverse metabolic profile associated with increased visceral fat accumulation rather than to subcutaneous fat, which comprises >85% of the total body fat. However using more sophisticated instruments, such as MRI, to accurately quantify fat in specific depots is impractical for in clinical setting. Simple anthropometric measures, which are known to correlate with fat distribution, would therefore be preferred [4]. Body mass Index, which is weight/ height^2, is a measure used to define overweight and obesity, but this measure does not provide enough information on fat distribution. Alternatively, Waist circumference could be measured and is simple enough to use in assessing abdominal obesity over time. However Waist Girth when correlated with Hip circumference, a measure that showed an independent and seemingly and protective effect on Cardiovascular Disease [5]. Without Hip girth taken into account waist circumference may underestimate the true cardiovascular risk. Waist Hip ratio may be an alternative measure to use because it is strongly predictive of cardiovascular risk in both men and women [6]. Even lean individuals (BMI<25 kg/m^2), an increased Waist Hip ratio was associated with higher cardiovascular risk, suggesting that the impact of excess visceral fat can be observed even without gaining so much weight as to be considered overweight or obese. However, despite the need to reduce excess weight in healthy individuals, the role of excess weight reduction in patients with known history of cardiovascular disease or diabetes needs further investigation. Skinfold thickness is also used as a measure of adiposity, but studies comparing its predictive ability to other measures of adiposity have produced inconsistent findings [7]. Indians have a low average body-mass index (20–30 kg/m^2) and low rates of obesity (10–15%) in association with higher prevalence of cardiovascular disease and diabetes.

Materials and methods

This was a standardized case control study conducted in Government Dharmapuri Medical College Hospital, Dharmapuri from May 2016 to May 2017.

Inclusion criteria

- Consecutive cases of newly diagnosed Myocardial Infarction.
- With/ without risk factors for IHD.

Exclusion criteria

- Old cases of Myocardial infarction/ unstable angina/ chronic stable angina.
- Cardiogenic shock
- Major Chronic diseases
- Age > 60 years due to non-reliability of skin fold thickness.

A total of 98 cases (49 Cases and 49 Controls) were selected. Newly diagnosed consecutive cases of myocardial infarction admitted to the department to the department of cardiology were enrolled into the study after obtaining consent. These patients were subjected to anthropometric measurements namely waist hip ratio, weight height, skin fold thickness and Lipid profile was done. Controls were selected from the outpatient clinic of Institute of Internal Medicine. Controls were matched for age, sex, risk factors. They were also subjected to anthropometric measurements and Lipid profile.

Body mass index

Weight was measured in KG's. The weighing apparatus was calibrated at the beginning of each and at the end of each stand. Weight was determined on a balance scale in light clothing to an accuracy of 100g.Height was measured using Audiometer in cm. Height was measured without shoes by a measuring tape against a wall to an accuracy of 0.1 cm with patient looking straight ahead, shoulders relaxed, arms by sides legs straight and knees together. Shoulder blades, buttocks and heels were touching the measurement surface. MI was calculated using the following formula. MI =Weight (in Kg) / Height in metre2.The study population was divided into two groups < 25 and ≥25 (World Health Organization 2000, p. 9-11) [8].

Waist hip ratio

Waist circumference was measured over unclothed abdomen at the midpoint between the iliac crest and the lowest rib. It was calculated as an average of one measurement taken after inspiration and one taken after expiration. Hip circumference was measured over light clothing at the level of the Tronchanteric major or widest diameter around buttocks. All anthropometric measurements were carried out once. WHR was calculated as waist divided by hip, and was used in the analyses either as a continuous variable or divided into sex-specific thirds [8, 9].

Skin fold thickness

All the skin folds were taken with Vernier calipers. The measurements are taken on the right side of the body. The fold of skin and underlying subcutaneous adipose tissue was gently grasped between the left thumb and forefingers. Enough skin and adipose tissue was grasped to form a distinct fold that separates from the underlying muscle. The skinfold was grasped 2.0 cm above the place, the measurement taken .The jaws of the calipers were placed at the marked level, perpendicular to the length of the fold, and the skinfold thickness was measured to the nearest 0.1 mm while the fingers continue to hold the skinfold. Skin fold measurements were taken at 6 sites namely Triceps, Biceps, Thigh, Subscapular, Suprailiac and Abdomen. The measurements were divided into two groups Central fat Mass (CFM) and Peripheral fat mass (PFM). For the assessment of CFM the sum of Abdominal, Suprailiac and Subscapular were used and for the assessment of PFM the sum of Triceps, Biceps and Thigh were used. The ratio of CFM to PFM was analyzed in both control and study group, sex wise (European Journal of Endocrinology, Volume 156, Issue 6, 655-661) [10].

Serum lipid profile

For venous blood specimen, participants were advised overnight fasting and blood sample drawn the other day morning and sent for analysis. Total cholesterol, HDL, Triglycerides were analyzed from the serum blood samples and LDL was calculated using the following formula:-LDL = TC –TGL/5 – HDL [11].

Results

The Mean age of patients in our study was 47.54±8.4yrs. Majority of patients were in the 4th to 5th decade at the time of presentation (**Table – 1**). Risk factors in case and controls were as per **Table – 2**.

It was statistically insignificant and showed a weaker association between IHD and BMI. The mean of the BMI in Females were comparable (22.12 in Cases, 21.82 in Controls) with that of males (22.17 in Cases, 21.48 in Controls) (**Table – 3**).

Table - 4, 5 shows waist hip ratio. For Males it was statistically significant, females it was statistically insignificant. 70.4% had abnormal ratio in cases than in controls (30%) in Males. In females 57.1% had abnormal ratio in cases than in controls (42.9%). Mean of WHR among males between the two groups were 0.97 (cases) and 0.87 (controls). Among the females the mean between the two groups were 0.96 (cases) and 0.87 (controls).

Table – 6 shows the skin fold thickness between the two groups for males and females respectively. The skin fold thicknesses were more in females than in males with the mean of sum of the central skin fold thickness in females (6.21) more than males (4.81) and the mean of sum of the peripheral thickness in.

Table - 7 shows correlation between the Waist hip ratio correlated well with LDL in males which is statistically significant. Sum of skin fold thickness and Central skin fold thickness correlated with LDL with a statistical significance. But the ratio of central to peripheral skin folds did not correlate with LDL.

Table - 1: Age distribution.

Age Group (in years)	Cases and Controls	
	Number	Percentage
< 30	6	6.74
31-40	14	14.28
41-50	38	38.77
51-60	40	40.81
Total	98	100
Mean	47.54 years	
Standard deviation	8.4 years	

Table - 2: Risk factors.

Risk factor	Cases	Percentage	Controls	Percentage
Smoking	32	65.3%	32	65.3%
Alcohol Intake	27	55.1%	27	55.1%
Diabetes	10	20.4%	10	20.4%
Hypertension	11	22.4%	11	22.4%
Family H/O IHD	11	22.4%	11	22.4%
No risk Factors	8	16.32%	8	16.32%

Table - 3: body mass index (both male and female).

Groups	BMI	Number	Percentage	P value
Cases	< 25	40	81.6%	0.13648
	≥ 25	9	18.4%	
Controls	< 25	45	91.8%	
	≥ 25	4	8.2%	

Table – 4: Waist hip ratio for males.

Waist hip Ratio	Cases	%	Controls	%	P value
Normal (≤ 0.88)	3	10.7%	25	89.3%	0.001
Abnormal (> 0.88)	38	70.4%	16	29.6%	

Table - 5: Waist hip ratio for females.

Waist hip Ratio	Cases	%	Controls	%	P value
Normal (≤ 0.81)	0	0%	2	100%	0.13
Abnormal (> 0.81)	8	57.1%	6	42.9%	

Table - 6: Sum of all skin fold thickness in both sexes.

Group	Males		Females	
	Mean	SD	Mean	SD
Cases	8.52	1.91	11.58	3.11
Controls	6.15	1.69	8.7	3.1
P value	0.001		0.085	

Table – 7: LDL for both sexes.

LDL	Cases	%	Controls	%	P value
< 130 mg/dl	16	28.1%	41	71.9%	0.00
≥ 130 mg/dl	33	80.5%	8	19.5%	

Discussion

In the western population numerous studies are being conducted on the association of obesity with cardiovascular risk. In India clinical regarding obesity and its role in Ischemic Heart disease are limited. This study is an attempt to emphasize the magnitude of the problem and to highlight the importance of early detection and treatment. A Standardized case control study was performed in 15152 cases of first myocardial infarction and 14820 age matched and sex matched controls [12]. The main purpose of the study was to assess whether markers of obesity especially waist to hip ratio would be a stronger indicator of myocardial infarction than body mass index [13]. BMI was only slightly higher or there was no difference between the cases and controls. Cases had a higher waist to hip ratio than controls, an observation consistent in all the regions of the world. The risk of myocardial infarction rose progressively with increasing values for waist hip ratio [14]. Waist circumference was strongly related to myocardial infarction risk and this relation was continuous and persisted even after adjustment.for BMI and Height. Waist circumference was intermediate between BMI and waist hip ratio. A trend towards lower risk of myocardial infarction was noted as hip circumference increased. This trend was highly significant after adjustment for BMI and height [15]. Of the two measures compared, BMI showed the weakest association with myocardial infarction risk in all ethnic groups with no significant relation in south Asians. BMI showed weak association with Myocardial infarction. Waist hip ratio was strongly correlated with IHD overall (P value of 0.001). Cases had higher waist hip ratio than controls overall [70.4% of cases had abnormal WH ratio when compared to controls (29.6%)]. Waist circumference was strongly correlated with IHD overall (0.0040). 67.5% of the cases had abnormal waist circumferences than controls (32.5%). Waist circumference was in between waist hip ratio and BMI. All these go with our study also. BMI of males and females were equal [16]. Waist hip ratio was significant in males (P value 0.001) but not significant in females (P value 0.31). Waist hip ratio was higher in males than in females. Both Central and peripheral skin fold thickness were more in Females than in males. Sum of the skin fold thickness were more in females than males.The skin fold thicknesses were more in cases than controls. The mean of the sum of central skin fold thickness was more in cases (4.81 in Males, 6.21 in Females) than in controls (3.47 in males, 4.65 in females). The mean of the sum of peripheral skin fold thickness was more in cases (3.71 in Males, 5.37 in females) than in controls (2.68 in Males, 4.05 in Females) [17]. Central skin fold thickness was more than the peripheral skin fold thickness. The mean of the sum of Central Skin Fold Thickness was more in CASES (4.81 in males, 6.21 in Females) and in Controls (3.47 in Males, 4.65in Females) than the mean of the sum of the peripheral skin fold Thickness In Cases (3.71 in Males, 5.37 in females) and in CONTROLS (2.68 in Males, 4.05 in Females) [18]. Optimal limit of body mass index (BMI) for Asian Indians remains to be defined. In this study, we describe the anthropometric and lipid profiles and determine the appropriate cut-offs of BMI for defining obesity in dyslipidemia patients. Correlations were carried out between lipid profile and anthropometric variables in 217 dyslipidemia Asian Indians and the data were compared to those of 123 healthy historical controls. Receiver operating characteristics (ROC) curve analysis was carried out to determine the appropriate cut-offs of BMI for defining obesity taking the percentage of body fat (% BF) as the standard. Values of sigma 4 SF ($P<0.001$), and percentage of BF ($P<0.001$) were significantly higher in females [19].

Conclusion

Waist hip ratio and waist circumference are better indicators of the cardiovascular risk in a given individual than BMI. Waist hip ratio is a significant factor in males but not in females. The central skin fold thickness was significant in males but not in females. For the same BMI, females had more uniform distribution of fat than males who had predominantly more distribution of fat in abdominal region. Central obesity leads to atherogenic lipid profile in both the sexes and places the individual at high risk of cardiovascular events [20].

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