

A study on the correlation between Body Mass Index of overweight/obese, Total Physical Activity and Cardiovascular risk factors with special reference to dyslipidaemia in adult women

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Abstract

Over weight and obesity increase the risk of cardiovascular diseases through many cardiac risk factors including dyslipidemia, hypertension, and diabetes. Hence, the study was carried out to analyze the correlation between Body Mass Index (BMI) of overweight/obesity with Total Physical Activity (TPA) and Dyslipidemia. Aged 18- 60 years overweight BMI between 25 -29.9 Kg/m² or obese BMI over 30 Kg/m² women were included in the study. Totally 121 overweight/obese women were participated in this study. Pregnant and disabled females were excluded. Total Cholesterol (TC), High-Density Lipoprotein (HDL), Triglyceride (TG) and Low-Density Lipoprotein (LDL) were investigated. TPA was analyzed as a separate variable. TC and LDL provided significant relationship between each other and HDL with TG and LDL gave weak negative relationships. TG was inversely associated with LDL. The highest physically inactivity (41.3%) was found in the age group 41-60 years and also the highest elevated TC (26.9%) and the highest abnormal LDL (25%) were found in the same age group. Similarly higher physically inactivity (33.9%) was found 31 – 40 years. In this age group elevated TC (19.2%) , the highest abnormal HDL (29.7 %) and the highest abnormal LDL (25%) were found. TPA inversely associates with TC. In this study over 50% overweight/obese adult women found more than one abnormal cholesterol levels such as elevated TC, elevated TG, elevated LDL and low HDL. 90 % participants were noted in sedentary level in activity. Therefore a study on wide range of the population is highly needed to come to a definite conclusion on the prediction of the relationship in between the overweight /obese, TPA and dyslipidaemia.

Introduction

Obesity/over weight is one of the important causative factor of all non communicable diseases. The rates of non-communicable diseases have been increasing alarmingly even in Sri Lanka during the last several years[1]. According

to research statistics for Asians, the percentage of Sri Lankan adults in the overweight, obese and centrally obese categories were 25.2%, 9.2% and 26.2%, respectively [2]. Obesity increases risk of Cardiovascular Diseases (CVD) through many cardiac risk factors including hypertension, diabetes and dyslipidemia [3]. CVD is the leading cause of death in high-income countries and even low- and middle-income countries [4] and has a strong relationship exists between blood cholesterol levels and deaths [5]. Further, in the past three decades numerous clinical and epidemiologic studies have shown repeatedly that an elevated blood cholesterol level is one of the major modifiable risk factors associated with the development of Coronary Heart Diseases (CHD)[6].

Coronary heart disease risk factors are conditions or habits that raise the risk of CHD and heart attack. These risk factors also increase the chance that existing CHD will worsen[7]. Development of CHD is influenced by a number of risk factors. The main modifiable risk factors for CHD are elevated blood cholesterol, high triglyceride with low HDL, elevated blood pressure, diabetes, excessive stress etc[8]. This study is specifically focused on CV risk factors of dyslipidaemia.

Body Mass Index (BMI) has been widely used to categorize the level of obesity. Increasing BMI has been related to health risks and deaths rates in many studies [3]. Waist Circumference (WC), a simple marker for central obesity, has also been reported to reflect cardiovascular risks [9]. Similar to BMI, the link with WC and related health risk is influenced by age, gender and ethnic differences, so that the

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choice of cut-off values for WC in prediction of cardiovascular risk are likely to be different among different populations [10]. Recent evidence suggests that Asian populations generally have a higher percentage of body fat compared to white people of the same age, sex and same BMI [11]. Furthermore, previous studies revealed that Waist to Hip Ratio (WHR) also a strong predictor of cardiovascular complications [12].

Sedentary lifestyle is one of the main causes for overweight and obesity in this new era. The sedentary lifestyle means a distinctive way of life of individual with almost no or poor or irregular physical activity. In this study physical activity has focused on measuring Leisure Time Physical Activities (LTPA) such as walking, swimming or other sport-related activities and Household Chores (HHC) such as washing, cooking and gardening. Considering these whole into one, a variable TPA was formed. The objective of this study was to analyze the relationship between Body Mass Index (BMI) of overweight/obesity with Total Physical Activity (TPA) and dyslipidemia.

Materials and Methods

Study Design and Participants

This study was conducted at the Ayurveda Teaching Hospital, Borella, Sri Lanka. This research was a cross-sectional study conducted from July 2012 through March 2013. Over 500 adult women were screened and included a convenience sample of 121 for this study. Female adults overweight (BMI between 25 -30 Kg/m² and obese (BMI over 30 Kg/m²) were recruited from Western Province. Age group of 18 to 60 years females were included. Participants who currently take weight loss medication were excluded in this study. Further the illnesses like gastrointestinal disorders, psychiatric illness, cushing's syndrome, hypothalamic etiology of obesity, uncontrolled or untreated thyroid disease, eating disorder such as bulimia were excluded. Also the participants who underwent a surgery in the past 3 months and surgery planned to do within 6 months were excluded. In addition pregnant women, disabled females and those who were on a special diet for medical reasons too were excluded from the study.

All voluntary and anonymous participants were read and signed informed consent about the purpose of the study. Each patient was attributed a personal number, from 1 to 121. The questionnaire developed for the study was organized in three areas: (1) anthropometric measures (2) information of TPA (3) and clinical and biochemical examination.

Anthropometry measurements

The complete set of anthropometric measurements was performed twice. Weight and height were obtained by standardized procedures. BMI was calculated as weight (kg) / height (m²). Blood pressure, Pulse, Waist and Hip measurements, were taken. For the assessment of Body Mass Index (BMI), participants were categorized by weight status according the cut-off values for BMI proposed by WHO. BMI (kg/m²) was used as a categorical variable, subjects were classified as follows: normal weight: 18.5-24.9 kg/m²; overweight: 25.0-29.9 kg/m²; or obese \geq 30.0 kg/m². Obese further categorized to obese I (BMI between 30 – 34.9 kg/m²), obese II (BMI between 35– 39.9 kg/m²) and morbid obese BMI \geq 40 kg/m² [13]. The hip measurement was taken just above the belly button and the waist measurement was taken at the widest part of the buttocks by using a non elastic plastic tape to the nearest 0.5 cm.[14].

Total Physical Activity (TPA) variable

One variable was predominantly used to assess the level of exercise themselves whether they were belong to sedentary or moderate active or high active. For analyzing purpose, we arranged them into 4 different physical activity levels: sedentary (0) light (1) moderate (2) and high (3).[15,16].

Biochemical assessment

Bio chemical variables included in this study were TC, HDL-C, LDL-C and TG. All the bio chemical variables were defined according to the new cholesterol guideline [17] as follows. Hypercholesterolemia is defined as fasting serum total cholesterol \geq 200mg/dl (5.17 mmol/l) and abnormal HDL-C is defined as HDL < 40mg/dl (1.03 mmol/l) for women. Elevated LDL-C is defined as LDL-C >130 mg/dl (3.36 mmol/l). Hypertriglyceridemia is defined as serum triglyceride >150 mg/dl (2.3 mmol/l). Dyslipidemia is defined as total cholesterol \geq 200mg/dl (5.17 mmol/l) or LDL-C >130 mg/dl (3.36 mmol/l.) or HDL < 40mg/dl (1.03 mmol/l) specially in females or triglyceride > 150 mg/dl (1.7 mmol/l).

Statistical Analysis

Statistical analysis were performed using the Statistical Package for the Social Sciences for IBM SPSS version 14. Analysis for frequency was run for socio-demographic variables. Means were calculated separately for anthropometric variables and biochemical variables.

Relationship within four variables of lipid profile (TC, TG, HDH, and LDL) was analyzed. Correlation was analyzed between the level of Total Physical Activity (TPA) variable with four variables of lipid profile (TC, TG, HDH, and LDL) separately. Multivariate analysis was run to analyze the frequencies of four variables.

Results

Mean Body Mass Index (BMI) of all participants was 32.01 (± 4.94). BMI was categorized according to the proposed classification of the World Health Organization (WHO) based on risk factors and morbidities [13]. The cut off points mentioned in the WHO report for overweight and obesity of adults are 25-25.9 kg/m² and ≥ 30 kg/m² respectively. Overall 41.3 % overweight and 58.7 % obese had found in this study. Out of this 58.7 % obese participants 35.5 % were obese I, 18.2 % were obese II and 5 % were morbid obese. The results showed that mean body weight was 77.28 Kg (± 12.40) and the mean height was 155.33 cm (± 6.72). The mean WC was 104.73 cm (± 10.52) and the mean Hip circumference was 109.15 cm (± 10.13). The mean of WHR was 0.95 (± 0.06). According to WHO's categorization, this study revealed that the mean WC and the mean of WHR showed extremely high risk level for type 2 diabetes, hypertension and heart diseases [14,18].

Table 1 discussed the variable of abnormal lipid levels and TPA found with different age groups among overweight/obese women. TPA was analyzed and about 91% of the participants showed sedentary level and 8% of

the participants showed a light physical activity level. Out of the 91% sedentary subjects 15.7% were in the age group 18-30 and their elevated TC was 3.8% , elevated LDL was 3.8% and low HDL was 4.2%. 33.9% of sedentary subjects were in the age group 31-40 years and their elevated TC was 19.2 % , elevated TG was 11.5%, elevated LDL was 25% and low HDL was 29.7%. 41.3% of sedentary subjects were in the age group 41-60 years and their elevated TC was 26.9 % , elevated TG was 3.8%, elevated LDL was 25% and low HDL was 6.3%. Among the above age groups 41-60 years showed the highest level of CV risk factors of dyslipidaemia.

In this study 40.4% of the population showed the borderline high TC level and 9.6% showed the high TC level. Further, 13.5% showed the borderline high TG level and only 1.9% showed the high TG level. Likewise 38.4 % showed the borderline high LDL level and 15.4 % showed the high LDL level. When HDL consider 40.4% showed abnormal HDL levels.

Table 1 : Abnormal lipid levels and Total Physical activity (TPA) between Age groups

Variables/ Age groups in years	18 – 30	31 – 40	41 – 60	Total
Variable of Dyslipidaemia	3.8	19.2	26.9	19.9
% High TC \geq 200mg/dl	0	11.5	3.8	15.3
% High TG \geq 150 mg/dl	3.8	25	25	53.8
% High LDL \geq 130 mg/dl	4.2	29.7	6.3	40.2
% Low HDL < 40mg/dl				
Variable of Physically activity				
Sedentary	15.7	33.9	41.3	90.9
Light PA	1.6	4.1	2.5	8.2
Moderate PA	0	0.8	0	0.8

HDL: High Density Lipoprotein cholesterol; LDL: Low Density Lipoprotein cholesterol; TC: Total Cholesterol; TG : Triglyceride; PA: Physically Activity

Table 2. Correlations between BMI and variables of WC, HC, WHR and CV risk factor of dyslipidaemia variables

Pearson Correlation

	BMI in Kg/m ²	WC	HC	WHR	TC	TG	LDL	HDL
BMI in Kg/m ²	-	-						
WC	.800**	-						
HC	.838**	.809**	-					
WHR	.071	.442	-.165	-				
TC					-			
Triglycerides					.150	-		
LDL					.895**	-.083	-	
HDL					.190	-.072	-.184	-

** $p < 0.01$ level.

Table 2 showed the results which was analyzed by Pearson correlation. A strong positive correlation is shown between BMI and WC or HC with $r(121)=0.8, p < 0.01$ and $r(121)=0.838, p < 0.01$ respectively. Further WC is positively correlated to HC and WHR with $r(121) = 0.809, p < 0.01$ level and $r(121) = 0.442$ respectively. Total cholesterol and LDL levels of the study participants were positively correlated with $r(121)=0.895 (p < 0.01)$ but the other CV risk factors such as HDL were inversely associated with TG and LDL with $P = -0.072, P = -0.184$ respectively. TG was inversely associated with LDL-C ($P = -0.072$)

Discussion

A striking finding of this study was high prevalence of major cardiovascular disease risk factors of dyslipidaemia such as abnormal TC and abnormal HDL-C were found highest percentage in the age group 41-60 years. The waist circumference directly reflects abdominal fat mass and has been suggested as an index of central obesity [19] which is an independent predictor for cardiovascular disease [20]. In this study, higher mean values were found in WC, HC and WHR for all age groups. Also it was reported that South

Asians may be related to insulin resistant, dyslipidemic, proinflammatory, prothrombotic state of abdominal obesity [21]. The results of this study also further confirm this statement and it was shown that central obesity is a prevailing problem among obese or overweight participants.

According to the results of this study, overweight or obese women had increased LDL-C, increased TC, - abnormal HDL-C and increased TG. In general, the relationship between different serum cholesterol levels such as TC and LDL-C gave significantly positive correlation. The relationship between LDL-C with HDL-C showed negative correlation. The conditions like increased TC, increased LDL-C and low of HDL-C are considered as bad indicators for cardiovascular risk.

Studies revealed that physical inactivity may contribute to the high prevalence of dyslipidaemia [22] and physical activity increases HDL-cholesterol concentration [23,24,25] and decreases triglyceride concentrations [26]. These data also show that 90% of women were physical inactive group. Also, it was found TPA inversely associates with TC.

Conclusion

Central obesity indices were significantly associated with BMI. The mean of central obesity indices were far higher than the cut-off indicated by WHO. In this study over 50% of overweight and obese adult women had found more than one or more dyslipidaemic factors. Also, poor TPA found in almost in all the age groups. The present study confirms the need of the awareness programmes among the population to encourage anti-obesity management and to increase physical activity. The population based effort should be focused on the community, including schools and media to reduce gaining of unwanted weight. However, a study on wide range of population is the need of the day to confirm the relationship in between the overweight /obese, TPA and dyslipidaemia.

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