FREQUENCY OF DYSLIPIDEMIA IN OBESE VERSUS NON - OBESE IN RELATION TO BODY MASS INDEX (BMI), WAIST HIP RATIO (WHR) AND WAIST CIRCUMFERENCE (WC)

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ABSTRACT: This comparative cross-sectional study was conducted at Liaquat University Hospital, Hyderabad, from March 2008 to August 2008. The two groups and total 200 subjects (100 in each group) attending medical out patient department were selected and their age, sex, BMI, WHR, WC and lipids profile were measured. Obese group included those who had high BMI (> 30), WHR (>1.0 for males and > 0.85 for females), and WC (>102 cm for males and >88 cm for females) and vice versa. The distribution of the lipid levels and the frequency of dyslipidemia were noted for both the groups. Obese subjects showed significant ($p \leq 0.05$) dyslipidemia. Thirty seven percent subjects had total cholesterol >200 mg/dl, 46% had high-density lipoproteins (HDL) cholesterol of <40 mg/dl, 31% had low-density lipoproteins (LDL) cholesterol of >130 mg/dl and 51% had triglycerides (TG) >150 mg/dl, while non-obese group also showed significant dyslipidemia. On comparing the lipid profile between these two groups, the mean value of total cholesterol was not different significantly ($P>0.05$) while the mean values of total HDL cholesterol, total LDL cholesterol and TG in obese group were different significantly ($P<0.05$) between the groups. It may be concluded that dyslipidemia is strongly associated with obesity but presence of dyslipidemia in non-obese group emphasizes the need for routine health screening for preventive measure.

Key words: Dyslipidemia, Obesity, Body mass index, Waist - hip ratio, Waist circumference.

INTRODUCTION

Obesity is a medical condition in which excess body fat accumulates to the extent that it may have an adverse effect on health, leading to reduced life expectancy and it is a complex, multi-factorial chronic disease. (Rankinen *et al*., 2006) Obesity is associated with many diseases, particularly heart disease, type 2 diabetes, breathing difficulties during sleep, certain types of cancer, and osteoarthritis. The prevalence of obesity is rising to epidemic proportions at an alarming rate in both developed "Westernized" and less developed countries around the world. (Mokdad *et al*., 1999)

The Body mass index (BMI; in kg/m^2) is widely used for the classification of overweight (BMI 25) and obesity (BMI 30) in men and women, (Ogden *et al*., 2006 and WHO, 1997). BMI correlates reasonably well with laboratory-based measures of adiposity for population studies, (Heymsfield *et al*., 1995) and is extremely practical in most clinical settings. However, BMI does not account for the wide variation in body fat distribution, the nature of obesity across different individuals and populations, and the joint relation of body composition and body size to health outcomes (Michels *et al*., 1998). Many studies have reported that body fat distribution is a more powerful predictor than is BMI for risk factors, diseases, and mortality (Albrink *et al*., 1964 and Larsson *et al*., 1984). Increased visceral or abdominal adipose tissues in particular have been shown to be more strongly associated with metabolic and cardiovascular disease risk and a variety of chronic diseases (Folsom *et al*., 1993 and Bjorntorp, 1993). Therefore, measurements that are more sensitive to individual differences in abdominal fat might be more useful than BMI for identifying obesity-associated risk factors (Reeder *et al*., 1997 and Lean *et al*., 1995). The waist circumference (WC) is a convenient measure of abdominal adipose tissue and is unrelated to height, correlates closely with BMI (Onat., 1999 and Lean *et al*., 1996) and total body fat, and is associated with cardiovascular disease risk factors independent of BMI. Accordingly, WC may be an effective clinical tool for assessing the risk of cardiovascular diseases (Okosun *et al*., 2000). Besides all the preventive measures that are screening for indices of obesity and dyslipidemia the prevalence of the obesity and its complications is increasing worldwide and is one of the major public health problems. The purpose of this study was to determine the relationship of lipid profile in obese versus non - obese patients and to determine the frequency of dyslipidemia in these two groups.

MATERIALS AND METHODS

This was a comparative cross –sectional study of 200 subjects attended the medical out patient department (OPD) from March 2008 to August 2008. All the subjects were ≥ 20 years of age, of either sex, irrespective of their co-morbid but no use of lipids lowering drugs have been selected. Pregnant females, person with ascites, CVA (cerebrovascular accident) etc and who for any reason cannot stand without support for the purpose of weighing and measuring height, and those who had BMI between 25 and 30 were excluded. All the subjects were divided into two groups (100 in each group): (1). Obese (body mass index - BMI > 30, waist to hip ratio - WHR > 0.85 in female and > 1.0 in male, waist circumference - WC > 88cm in female and > 102 cm in male). (2). Non – obese (body mass index - BMI < 25, waist to hip ratio - WHR < 0.85 in females and < 1.0 in males, waist circumference - WC < 88cm in females and <102 cm in males). The subjects were counseled regarding obesity and current survey based study and after the over night fasting of 12 – 14 hours, weight was measured by machine that was daily calibrated by using a weight of 5 Kg and height was measured in standing position without shoes, at the level of vertex by using the wall scale. Waist was measured by measuring tape halfway between the lower costal margin and the iliac crest and the hip circumferance was measured over the widest part of gluteal region. The blood sample (05ml) was drawn from antecubital veins in sitting position for lipid profile. The measurement tools used were BMI = weight in kg / height in meters (square) i.e. mass (kg) / height^2 (m^2); waist hip ratio (WHR) = waist circumference / hip circumference. Laboratory parameters; cholesterol (TC), low density lipoprotein (LDL), high density lipoprotein (HDL), and triglyceride (TG) were determined directly by analyzer using instrument Roche/ Hitatchi 911 Automated Chemistry Analyzer. The presence of dyslipidemia was considered according to updated National Cholesterol Education Programme (NCEP) Adult Treatement Panel III (ATP III) recommendations (Anonymous, 2000). All the data were recorded and analyzed through computer package SPSS (Statistical Package for Social Science) version 11.00. The results were given in text as mean and standard deviation (SD) for continuous variables (age, lab investigations, etc) and frequency / percentages for categorical variables (gender, symptoms, etc). The student t- test was used for comparison between categorical variables i.e. lipid profile among obese and non – obese subjects at $P \leq 0.05$.

RESULTS

One hundred subjects were included in each group on the basis of their BMI, WHR and WC. Those

Table: 01 : Age and gender distribution of obese and non obese subjects

	Age	***Gender***		***n* = 200**
		Male	**Female**	
Obese (*n* = 100)				
	20 - 29	3	1	04
	30 - 39	9	3	12
	40 - 49	12	2	14
	50 - 59	15	5	20
	60 - 69	17	7	24
	70 - 79	22	4	26
	Non-Obese (*n* = 100)			
	20 - 29	2	1	3
	30 - 39	5	7	12
	40 - 49	09	11	20
	50 - 59	11	13	24
	60 - 69	13	15	28
	70 - 79	5	8	13

Table: 02 : Clinical characteristics of obese and non obese subjects

Parameter	**Obese (100)**		**Non obese (100)**	
	Male	**Female**	**Male**	**Female**
Age (years)	54.21±9.0	52.13+7.5	40.2±2.81	37.52+4.3
Weight (kg)	90.52+12.42	88.63+10.0	68.51+4.87	56.43+3.21
Height (m)	1.761+2.331	1.676+1.71	1.701+0.23	1.645+0.54
BMI (kg/m^2)	33.64+2.51	31.51+1.54	24.21+2.13	22.53+1.12
WHR	0.98+1.75	0.831+1.82	0.92+0.63	0.78+0.32
WC (cm)	106.53+9.52	87.64+6.45	84.41+4.55	76.33+2.54

Table: 03: Biochemical characteristics of obese and non obese subjects

Parameter	Obese (100)		Non obese (100)	
	Male	Female	Male	Female
Mean total cholesterol (mg/dl)	202.51+42.51[a]	200.44+33+42[a]	185.21+15.41[b]	180.35+17.48[b]
Mean HDL cholesterol(mg/dl)	34.55+ 16.58[d]	33.78+14.27[d]	38.78+12.12[e]	36.75+14.56[e]
Mean LDL cholesterol (mg/dl)	125.72+13.54[f]	120.51+10.76[f]	55.62+15.82[g]	49.12+18.96[g]
Mean total TG (mg/dl)	173.64+11.85[h]	170.87+13.74[h]	117.42+11.77[i]	113.21+13.98[i]

[a]P = 0.07, [b]P = 0.42, [d]P <0.05, [e]P <0.02, [f]P < 0.001, [g]P <0.05, [h]P < 0.03, [i]P <0.001

who have normal values of all three were included in non-obese group and vise versa. In our study population the age ranges from twenty to seventy nine years (20-79 yrs), their detail distribution and mean ± SD is mentioned in Table: 01. Majority of the persons were between 35 to 65 years. There were one twenty three (123) males and seventy seven (77) females respectively. The male has shown predominance with a ratio of 1.59:1 with females. The baseline characteristics of the study population showed the prevalence of co-morbid more in obese group as compared to non-obese group. The National Cholesterol Education Programme (NCEP) has laid down the cut off values for the presence of dyslipidemia. These values are very important in classifying the patients and making therapeutic decision. The majority of subjects from both (obese as well as non obese) groups were belonged to urban population. Thirty seven percent (37%) had borderline hypercholesterolemia, 46% had HDL-cholesterol of <40 mg/dl, 31% had LDL cholesterol of >130 mg/dl and 51% had TG >150 mg/dl. Twenty nine percent (29%) had a total cholesterol >200 mg/dl, 32% had HDL-cholesterol of <40 mg/dl, 22% had LDL cholesterol of >130 mg/dl and 24% had TG >150 mg/dl. The clinical and biochemical characteristics are mentioned Table: 02 and Table: 03

DISCUSSION

Obesity is associated with cluster of metabolic complications, increasing the risk hypertension, insulin resistance/type 2 diabetes, coronary heart disease, dyslipidemia, all aggregate independently with BMI, WHR and WC and improve with weight loss (Shirai, 2004). Dyslipidemia, a group of biochemical disorders is frequently encountered in obese individuals. The dyslipidemia associated with obesity no doubt plays a major role in the development of atherosclerosis and CVD in obese individuals. All of the components of the dyslipidemia, including higher triglycerides, decreased HDL levels, and increased LDL particles, have been shown to be atherogenic (Howard *et al*., 2003). It is a critical risk factor to intercept in both the primary and secondary prevention of acute cardiovascular events (Toth, 2004). It has been suggested that BMI should be routinely assessed in primary care clinics for both adults and children in order to facilitate early identification, evaluation and treatment of obesity and its related disorders. Beside all these new strategies for early reorganization, prevalence of the obesity and its complications is increasing worldwide and is one of the major public health problem. Present study also shows significant dyslipidemia beside all of these preventive measures. The largest survey of the relationship of obesity on lipids is the Third National Health and Nutrition Examination Survey (NHANES) also shows that dyslipidemia is strongly associated with obesity as compared to non obese, irrespective of age, sex, and race (Flegal *et al*., 1998). Previously only BMI was used as an indicator of obesity and used as a screening tool for the risk assessment of metabolic syndrome. But several studies have shown that even normal weight subject, those with a BMI <25 may have the presence of metabolic risk factors. The upper body fat that was related to dyslipidemia in normal weight subjects and simple anthropometric variables, WC and WHR, may be useful for screening and management of dyslipidemia in these subjects (Ito *et al*., 2004). The waist circumference, and not BMI, that explains obesity-related health risks (Janssen *et al*., 2004). National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) also shows similar data that presence of abdominal obesity is more highly correlated with the metabolic risk factors than is an elevated BMI. So simple means of waist circumference is recommended (WC > 88cm in women and > 102 cm in men) identify the body weight component of the metabolic syndrome (Anonymous, 2000). On the basis of these revised data the present study included two groups: obese versus non obese. Obese included those who have high BMI, as well as high WHR and WC values (according to NIH cut off values) and non obese group included those who have normal BMI and normal WHR and WC. Although this study was done on 200 subjects only, does not represent

the entire population of Pakistan. However, it provided us the opportunity to see the prevalence of dyslipidemia in these two groups. The result of this study indicates the high prevalence of dyslipidemia in obese as compared to non obese and all the lipid components were statistically significant, except that of total cholesterol. But this study also shows significant dyslipidemia in non-obese group. The presence of dyslipidemia in non-obese group could be due to different socioeconomic conditions, dietary habits, as subjects suffering from diabetes mellitus, coronary heart diseases and hypertension were not excluded. Moreno showed that weight loss associated with improvement in metabolic cardiovascular risk factors in obese patients even if they don't result in normalization of body weight (Moreno *et al*., 2000 and Bays, 2004). But the non obese group in the present study had not only BMI but WC and WHR values also normal. So the presence of dyslipidemia in non obese group could be due to the fact that the definition of central obesity using WC may not be appropriate for Asians. The NCEP ATP- III criteria, applied to an Asian population, would underestimate the population at risk and with a lower waist circumference cutoff; the prevalence of the metabolic syndrome is comparable to that in Western populations (Tan *et al*., 2004). The Asian Indians have excess cardiovascular risk at BMI and WC values considered "normal" and these data suggested that definitions of "normal" ranges of BMI and WC need to be revised for Asian population (Vikram *et al*., 2003). We knew that our study does not excluded the co-morbid illnesses and other risk factors that contribute to dyslipidemia but still evidences showed that central obesity is strongly related with metabolic syndrome and that the recommended values for BMI and WC may not be appropriate for Asians. So we need to revise the normal ranges of BMI and WC for Asians and the screening for indices of obesity and dyslipidemia should be incorporated into routine clinical examinations in all vulnerable populations for early detection and prevention of coronary artery diseases.

CONCLUSION : This study was designed to find out the frequency of occurrence of dyslipidemia in obese and non-obese. Since both dyslipidemia and obesity are the risk factors for coronary artery diseases (CAD), these may be the marker for the future development of CAD. The prevalence of dyslipidemia in asymptomatic subjects emphasizes the need for routine health screening for early preventive measure. The influence of BMI, WHR and WC on metabolic and CVD are multiplicative. So the weight loss should be urged for all those with a high body mass index or normal BMI but high WHR or WC.

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