

Pattern of Dyslipidemia in Type 2 Diabetic Patients in Southern Odisha

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Abstract: Diabetes mellitus (DM) is a major cause of coronary heart diseases (CHD) and frequently associated with factors like obesity, dyslipidemia and hypertension. Dyslipidemia in DM commonly manifests as raised low density lipoprotein (LDL), decreased high density lipoprotein (HDL) and elevated triglyceride (TG). Abnormal plasma lipid concentrations are related to anthropometric parameters. However, these associations have not been thoroughly examined in type 2 DM patients with dyslipidemia. To study the pattern of dyslipidemia among patients with type 2 DM. To determine the correlation of body mass index (BMI), waist circumference (WC) and body fat% with lipid profile in the study group. Total 403 adult subjects with diagnosed type 2 DM with dyslipidemia were recruited for the study. Estimation of lipid profile, fasting blood glucose and anthropometric measurements were conducted. Combined dyslipidemia (LDL with TG) was the most common type of dyslipidemia, followed by isolated dyslipidemia (LDL). TG was positively correlated with BMI ($r=0.224$, $p<0.0001$), WC ($r=0.280$, $p<0.0001$), Fat% ($r=0.147$, $p=0.003$). TC was positively correlated with BMI ($r=0.156$, $p=0.002$) and WC ($r=0.203$, $p<0.0001$). LDL ($r=0.250$, $p=0.005$), TG ($r=0.349$, $p=0.001$) and TC ($r=0.278$, $p=0.004$) was positively correlated with fasting blood glucose. Majority of type 2 diabetic patients in this study had inadequate control of plasma lipid. Moreover, poor glycemic control, over weight and obesity were strongly associated with abnormalities in lipid levels.

Keywords: Dyslipidemia, Lipid profile, Type 2 diabetes mellitus, Southern Odisha.

INTRODUCTION

Diabetes mellitus (DM) is a major cause of coronary heart diseases (CHD) and frequently associated various other cardiovascular risk factors. It is well established that dyslipidemia is a major risk factor for macrovascular complications in patients with type 2 diabetes mellitus (T2DM) and affects 10 - 73% of this population [1-4]. Approximately 80% of death in patients with diabetes is attributable to cardiovascular disease. Asian Indians have an increased risk of cardiovascular arterial disease (CAD) [5]. Dyslipidemia in diabetes commonly manifests as raised low-density lipoprotein (LDL), decreased high density lipoprotein (HDL) or elevated triglyceride (TG) [6-7]. Various studies have shown correlation of anthropometric parameters such as BMI, WC and Body Fat % with lipid profiles in healthy volunteers [8-10]. However, information on correlation of plasma lipid concentration to anthropometric parameters in type 2 DM with dyslipidemia is limited.

With this background the aim of this study was to study the pattern of dyslipidemia among patients with

type 2 DM and to find correlation of body mass index (BMI) and waist circumference (WC) and Body fat% with lipid profile in the study group.

MATERIALS AND METHODS

After approval of the institutional ethical committee a cross-sectional hospital based study was conducted during the period May 2015 to Jan 2016. Four hundred and three patients (satisfying the inclusion and exclusion criteria) attending outpatient endocrine department of MKCG Medical College and Hospital, Berhampur was recruited for the study, after obtaining written consent for participation. Patients were referred to regional diagnostic center for laboratory investigations. A proforma form was also given to all subjects where details about diet, smoking/alcohol, history of any medical illness, past medical history and family history were obtained. Subjects reported with 12hrs fasting and anthropometric measurements were obtained. Venous blood sampling was carried out for lipid profile and fasting blood sugar estimation.

Inclusion criteria

- Men and women Aged ≥ 40 years with established T2DM
- Diabetics defined as per the American Diabetes Association criteria issued in 2015
- $HbA_{1C} \geq 6.5\%$ or
- $FPG \geq 126$ mg/dl or
- 2 hr plasma glucose ≥ 200 mg/dl or
- In symptoms of hyperglycemia $RPG \geq 200$ mg/dl or
- Controlled diabetes (taking any antidiabetic medications)

Exclusion criteria

- Known type 1 DM
- Acute cerebrovascular and cardiovascular disease
- History of malignancy
- Active liver disease
- Chronic kidney disease
- Uncontrolled hypothyroidism
- H/O alcohol or drug abuse
- Initiation of hormone replacement therapy
- Pregnant or breast feeding women
- Lipid lowering drugs

Anthropometric measurement

Weight: By digital weighing scale to nearest 0.1kg.

WC: By fiber optic measuring tape in unclothed abdomen on standing position at the end of a normal expiration at the midpoint between the lowest rib and the iliac crest to the nearest 0.1cm. BMI: (By Quetlet's formula): (Weight in kg) / (Height in meter)².

Body fat%: By Omron Body Fat Monitor (HBF-306).

Laboratory investigations: Serum lipid profile and serum fasting blood sugar was measured by fully automated analyzer (TOSHIBA- 120FR).

Patients with one or more parameters (viz. LDL, TG, HDL, TC) outside the targets recommended by American Diabetes Association (ADA) 2010 (LDL: < 100 mg/dl; HDL: > 40 mg/dl (Male), > 50 mg/dl (Female); TC: < 150 mg/dl, TG: < 150 mg/dl) were considered to have dyslipidemia.

Dyslipidemia was divided into three types: isolated dyslipidemia (one of lipid fraction is out of target level) and combination dyslipidemia (two lipid fractions are out of the target level) and mixed dyslipidemia (three lipid fractions are out of the target)[11].

BMI were classified According to WHO criteria: Obese (BMI >25 kg/m²), Overweight (BMI >23 kg/m²), Normal range (BMI <23 kg/m²).

Cut-off values for central obesity including WC for men and women were ≥ 90 cm and ≥ 80 cm and body fat% for men and women were $\geq 25\%$ and $\geq 30\%$ respectively [12-14].

Statistical Analysis

Data were expressed in mean and standard deviation and comparison of parameters among male and female group was statistically tested by unpaired t-test. Pearson's correlation coefficient (r) was used to find the correlation of age, weight, BMI, waist circumference, body fat% and FBS with lipid profile parameters. Two tail p value <0.05 was considered statically significant. Statistical analyses were carried out in Microsoft Excel 2010[15].

RESULTS

Out of 403 type 2 diabetic patients, 362(89.93%) were males and 41(10.17%) were females. The mean age for subjects was 51.97 ± 8.58 years as shown in Table 1. Majority of patients in our study were obese (47.7%) or overweight (36.5%) and the mean BMI was 27.74 ± 4.73 kg/m². The subjects in our study had uncontrolled DM with fasting blood glucose (147 ± 49.03 mg/dl). Mean value of LDL and Total Cholesterol were above the optimal levels, while TG and HDL were within optimal levels. Female had lower TC and TG compared to males (Table 2).

The most common pattern of dyslipidemia in our study was isolated dyslipidemia in which 44.9% of patients had one of the lipid fractions out of target. Elevated LDL (60%) had highest percentage followed by lower HDL level (22%) and elevated TG (17%) and 27% of subject had combination dyslipidemia which represent the second most common pattern of dyslipidemia. LDL and TG (67.8 %) represent the majority of combination dyslipidemia followed by LDL and HDL (22%), HDL and TG (13%). The majority of subject (80%) had at least one lipid fraction out of target.

Table-1: Basic demographic and anthropometric parameters in study sample (n=406) expressed in mean and standard deviation

Parameters	Overall (n=406)	Male (n=362)	Female (n=41)	P value
Age (years)	51.97±8.58	51.58±8.92	55.44±2.97	0.006*
Weight (kg)	67.29±14.44	68.29±13.44	58.41±19.41	<0.0001*
BMI (kg/m ²)	27.74±4.73	27.74±4.41	27.68±7.01	0.9387
WC (cm)	92.17±11.99	92.48±11.57	90.41±15.11	<0.0001*
Fat%	26.77±6.39	26.00±5.70	33.49±8.14	<0.0001*
FBS (mg/dL)	147.53±49.03	-	-	

*Statistically significant p of unpaired t-test

Table-2: Serum lipid profile in study sample (n=406) expressed in mean and standard deviation

Parameters	Over all (n=403)	Male (n=362)	Female (n=41)	P values
TC (mg/dL)	194.49±39.58	197.14±40.06	171.12±25.31	<0.0001*
LDL(mg/dL)	118.57±38.89	119.39±39.73	111.24±29.94	0.20
HDL(mg/dL)	45.74±9.54	45.77±9.51	45.46±9.94	0.84
TG(mg/dL)	150.18±62.39	152.28±65.39	131.63±11.85	0.04*

*Statistically significant p of unpaired t-test

Table-3: Correlation of lipid profile with age, anthropometric parameters, body fat percent and fasting blood glucose

	Total Cholesterol		LDL-Cholesterol		HDL-Cholesterol		Triglycerides	
	r	P	R	P	R	P	r	P
Age (years)	0.266	<0.0001*	0.327	<0.0001*	-0.041	0.416	-0.095	0.056
Weight (kg)	0.161	0.001*	0.111	<0.0001*	-0.204	<0.0001*	0.252	<0.0001*
BMI (kg/m ²)	0.156	0.002*	0.077	0.125	-0.161	0.001*	0.224	<0.0001*
WC (cm)	0.203	<0.0001*	0.163	0.001*	-0.161	0.001*	0.280	<0.0001*
Fat%	0.003	0.959	0.101	0.043*	-0.254	<0.0001*	0.147	0.003*
FBS (mg/dL)	0.278	0.004*	0.250	0.005*	-0.201	<0.0001*	0.349	0.001*

*Statistically significant p of unpaired t-test

Table-4: Percentage of pattern of type 2 diabetic patients (n=403) with all within control, one, two and three out of recommended target established by ADA2010

	Serum lipid profile	No. of Patients	Percentage (%)
All within target		74	18
One out of target 181(44.9%)	LDL	110	60
	HDL	40	22
	TG	31	17
Two out of target 109(27%)	LDL+TG	74	67.8
	HDL+TG	13	13
	LDL+HDL	22	22
Three out of target		39	9

DISCUSSION

In the present study we found the mean values of TC (mg/dL) 194.49±39.58, LDL-C (mg/dL) 118.57±38.89, HDL-C (mg/dL) 45.74±9.54 and TG (mg/dL) 150.18±62.39 respectively. The results of this study showed higher dyslipidemia than those in Malaysia [16], Brazil [17], Chile [18], Bangladesh [19] and Vietnam [20]. However, it was lower than Indian study by Bhatt *et al.* [21].

The mean FBS was 147±49.03mg/dl which suggests poor glycemic control in the patients, reflected

by higher values of fasting blood sugar which is consistent with previous reports from Indian studies by Borle *et al.* and Bhatt *et al.*[20,22] This result suggests more attention by healthcare providers in following the optimal guidelines to achieve the desired glycemic control. In addition, there is critical need to ensure patient compliance to medication and healthy lifestyle to avoid poor glycemic control.

The most common pattern was combine dyslipidemia (increase LDL and high TG) in 67.8% cases, followed by isolated increase in 60% cases. In contrast to the result of other Indian studies done by

Borle, Rakesh *et al.* and Pandya H *et al.* we found mixed dyslipidemia as the most common pattern of dyslipidemia in diabetic patients [20, 23, 24]. The difference in pattern of Dyslipidemia might be due to difference in diet, life style, occupation and level of education among diabetic patients [25].

Our study demonstrates the correlation of the lipid fraction with different variable. LDL was significantly positively correlated with age, suggesting that the younger patients in our study were more compliant to pharmacological therapy and/or non-pharmacological therapy than the older patients. Our finding was consistent with Ali *et al.* findings [26], while Blebil AQ *et al.* found LDL negatively correlated with the age [16]. Eid *et al.* and Nadeem *et al.* found that LDL was not correlated with age[27-28].

TC, LDL and TG were positively correlated with FBS (Table 3). This significant correlation suggests that poor glycemic control is associated with hypercholesterolemia, elevated LDL and elevated TG. Our findings consistent with Blebil *et al.* and Chowta *et al.*[16,29].

Overweight or obese diabetic patients have a high burden of CHD risk factors including dyslipidemia (high LDL, low HDL and high triglycerides) [30,31]. TG was positively correlated with BMI, waist circumference and body fat%.

HDL was negatively correlated with weight, BMI, WC and fat%, while LDL had a positive linear relationship with WC and body fat%. TC was positively related with WC and BMI. In a study from North India by Sandhu *et al.* reported positive correlations between body fat %, LDL and TC. Study conducted by Blebil *et al.* and Chan *et al.* found LDL positively related with BMI and WC, HDL had linear relationship with BMI and WC while TG had a positive linear relationship with these variables [16,32]. Indian study by Himabindu Y *et al.* found only positive correlation between BMI and LDL[33]. These studies reveal that lipid profile pattern and anthropometric parameters may vary from one geographical region to other among different races and ethnical groups.

Limitations

This study had some limitations. Convenience sample was taken from hospital outdoor, which may not represent the whole type 2 diabetic population of southern Odisha. Body fat% was measured by handheld bioelectrical impedance analysis based device which is not the gold standard procedure to measure body fat%.

CONCLUSION

Majority of type 2 DM patients with dyslipidemia had inadequate control of plasma lipids. This fact demonstrates the importance of early

intervention for control and treatment of these risk factors for prevention of cardiovascular complication in these patients. Furthermore poor glycemic control was strongly associated with abnormalities in lipid levels. These results along with high prevalence of overweight and obesity in type 2 DM suggest that diabetic patients should be counselled regarding their diets, physical activity and lifestyle modifications. These patients also need frequent monitoring to ensure optimal lipid level control.

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