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A comparative study on lipid profile of type 2 diabetes mellitus patient with healthy subjects: A hospital based study

Dr. Nandani[1*], Dr. Abhay Kumar[2], Dr. Nipendra Kishore[3], Dr. Ajay Khanna[4]

[1] Consultant, Department of Biochemistry, S.K. Memorial, Hospital, Dehradun, Uttarakhand, India

[2] Associate Professor, Department of Surgery, Government Doon Medical College and Hospital, Dehradun, Uttarakhand, India

[3] Senior Resident, Department of Orthopaedics, Katihar Medical College, Katihar, Bihar, India

[4] Associate Professor, Department of Medicine, Subharti Medical College, Dehradun, Uttarakhand, India

Abstract

Objectives: objective of our study was to compare the lipid profile of type 2 diabetes mellitus patients with healthy individuals.

Methods: A detail history, clinical examination and relevant investigations were performed to all cases. Plasma glucose estimation was performed by using RFCL kit on the microlab -300 Semi Auto- analyzer supplied by Merck. Total cholesterol was estimated quantitatively by CHOD-PAP technique. Serum Triacylglycerol was estimated quantitatively by GPO-ESPAS technique.

High density lipoproteins (HDL-C) was estimated quantitatively by PEG-PAP method.

Very low density lipoproteins (VLDL-C) was estimated from serum triacylglycerol level using Friedewald formula and low density lipoproteins (LDL-C) was calculated by subtracting serum HDL and VLDL from total serum cholesterol.

Results: Data was analyzed with the help of SPSS software. P value was taken ≤ 0.05 for significant differences.

Conclusions: This present study was concluded that diabetic state had deleterious effects on lipid profile. All constituent of lipid profile was increased in patients with type 2 diabetes mellitus except HDL which was a negative trend with advancing age of patients with diabetes mellitus as compared non diabetes mellitus healthy subjects. Hence, as state of diabetes mellitus was increased, constituent of lipid profile were also increased except HDL.

Keywords: type 2 diabetes mellitus, plasma glucose, lipid profile

Introduction

Diabetes mellitus is a group of metabolic disorders characterized by hyperglycaemia resulting from defects in insulin secretion, insulin action or most commonly both. The worldwide prevalence of diabetes mellitus (DM) has risen dramatically over past two decades from an estimated 30 million cases in 1985 to 177 million in 2000. Based on current trends, more than 360 million individuals will have diabetes by the year 2030 [1] The chronic hyperglycaemia of diabetes and attendant metabolic deregulation may be associated with secondary damage in multiple organ system especially the kidneys, eyes, nerves, heart and blood vessels [2].

The prevalence of disease in adults was found to be 2.4% in rural and 4-11.6% in urban dwellers. High frequencies of impaired glucose tolerance, shown by various prevalence studies of diabetes mellitus in India ranging from 3.6-9.1%, indicate the potential for further rise in prevalence of diabetes mellitus in coming decades [3].

Incidence of diabetes mellitus is increasing sharply in the developing countries as people adopt more sedentary life styles, with India and China being the largest contributors to diabetic load [4].

Diabetes mellitus is classified on the basis of pathogenic process that leads to hyperglycaemia. The vast majority of cases of diabetes fall into two broad classes, type 1 and type 2. Diabetes mellitus type 1(DM type 1) accounts for approximately 5- 10% of all cases. It is an autoimmune disease in which primarily immune effectors cells reacting against endogenous beta cell antigens cause islet destruction. Diabetes mellitus type 2 (DM type2) is more common and accounts for 90- 95% of diabet0ic patient. It is a heterogeneous group of disorder characterized by variable degrees of insulin resistances, impaired insulin secretion [4].

Diabetes mellitus is a common secondary cause of dyslipidaemia. Many features of diabetic dyslipidaemia can be explained by reduced action of insulin at the tissue level. This could be due to insulin resistance, although relative insulin deficiency associated with pancreatic beta-cell dysfunction also contributes [1]. Some features of diabetic dyslipidaemia, however, may not be due to insulin resistance. The lipid changes associated with diabetes mellitus are attributed to increased free fatty acid flux secondary to insulin resistance. There is increased free fatty acid release from insulin resistant fat cells. The increased flux of free fatty acid into the liver in presence of adequate glycogen stores promotes Triglyceride (TG) production which in turn stimulates the secretion of apoprotien B (apoB) and VLDL- cholesterol. The impaired ability of insulin to inhibit free fatty acid (FFA) release leads to enhanced hepatic VLDL -cholesterol production [5]. After the age of 20 years, the LDL cholesterol concentration increases progressively in men and women, but more rapidly in men, accounting for most of the overall gender difference in total cholesterol. The LDL cholesterol levels reach a plateau in men between the age of 50 and 60 years, and in women

between the age of 60 and 70 years [6]. Objectives of our study was to compare the lipid profile of patients with type 2 diabetes mellitus with healthy subjects.

Materials and methods

This study was conducted in department of Biochemistry, Katihar Medical College and Hospital in collaboration with the Department of Medicine during a period from January 2011 to December 2011. The patients were in uniformity in socioeconomic status, culture and food habits. Entire subjects signed an inform consent approved by institutional ethical committee of Katihar Medical College, Katihar, Bihar, India was sought.

Methods

A total of 36 type 2 diabetic patients (DDM) with dyslipidemia with middle age (40-50 years) were randomly selected as case group and 36 healthy individuals with age 30-40 years were selected as control.

Inclusion criteria

The participants were allowed to pursue their treatment schedules and regular lifestyles during this study including drug intake & tobacco addiction. (Smokers were defined as consuming ≥5 cigarettes per day and were smoking continuously for a minimum of six months prior to being enrolled.

Exclusion criteria

Patients less than or equal to ≥ 25 years of age, suffering from any other hormonal disorders, benign or malignant disorders, diabetic ketoacidosis, febrile conditions, renal failure and other renal diseases, gastroenterological conditions, liver diseases, transplant rejection, diseases of the central nervous system and pregnant ladies were excluded from this study.

Study Design

Random sampling methods were used to select the subjects.

The diagnosis of diabetes mellitus was based on World Health Organization (WHO) criteria i.e.

1. Fasting plasma glucose of 126 mg/dl (7.0 mmole/L) or more, after a minimum of 12-hour fasting, with symptoms of diabetes
2. A 2 hours - post prandial plasma glucose level of equal or more than 200 mg/dl (11.1mmole/L).

Old diabetics were also re-confirmed for their present biochemical status. Post prandial blood samples were drawn 2 hours after ingestion of glucose in 300 ml of water at 1.75 grams of glucose per kg body weight with a maximum of 75 gms of glucose).

Fasting blood samples were used for estimation of all the parameters except for the postprandial serum glucose estimation [7].

All the biochemical estimations were done by using RFCL kit on the microlab -300 Semi Auto- analyzer supplied by Merck.

Fasting and postprandial serum glucose were estimated quantitatively by GOD/POD technique as described by Trinder (1969).

Total cholesterol was estimated quantitatively by CHOD-PAP technique as described by Allian C.C (1974).

Serum Triacylglycerol was estimated quantitatively by GPO-ESPAS technique as described by Buccolo G and David M (1973).

High density lipoproteins (HDL-C) was estimated quantitatively by PEG-PAP method.

Very low density lipoproteins (VLDL-C) was estimated from serum triacylglycerol level using Friedewald formula

Low density lipoproteins (LDL-C) was calculated by subtracting serum HDL and VLDL from total serum cholesterol [8, 9].

Statistical analysis

Data was analyzed using SPSS software. Two tailed Student's t test was used to compare the means of different parameters. P values less than 0.05 was considered as significant. Person's r value was used to estimate the correlation between two relevant variables. Person's r value 0 indicates no correlation while +1 or -1 means perfect positive or negative correlation respectively.

Results

A total of 36 type 2 diabetes mellitus with dyslipidemia (DDM) patients and 36 healthy individuals with irrespective of sex were enrolled in this study.

Table 1: Demographic details of case and control

Groups	Numbers (n)	Mean Age(Yrs) ± SD	Sex ratio (M/F)
Case DDM	36	46.02 ± 0.422	1.25
Control	36	35.19 ± 0.437	2.60

As shown in table 1, mean age of overall case group was 56.51 ± 0.865 yrs while sex ratio was 1.57. Mean age of DDM, DDO and NDDO groups were 46.02 ± 0.422 yrs., 56.77 ± 0.392 yrs. and 66.75 ± 0.637yrs respectively. While the sex ratio in these three groups were 1.25, 3.50 and 1.00 respectively. Mean age of control group was 35.19 ± o.437 yrs. and sex ratio was 2.60.

Table 2: Lipid profile and blood glucose level in Middle aged (40-50 years) Diabetic Dyslipidemic Patients (DDM) (n=36).

	Mean	SD	SEM	R values
FBS	202.6111	44.67296	7.44549	.164
PPBS	268.7222	54.62318	9.10386	.023
TC	281.6389	39.30987	6.55164	.470
HDL	30.5833	2.54530	.42422	-.415
LDL	180.8500	38.01429	6.33572	0.31
VLDL	67.2278	7.43969	.23995	.254
TG	336.1389	37.19843	6.19974	.264

As shown in table 2 mean FBS and PPBS levels were 202.6 mg/dl and 268.72 mg/dl respectively in DDM group. Mean TC, HDL, LDL, VLDL and triglyceride level were 281.6389 ± 39.09 mg/dl, 30.58 ± 2.54 mg/dl, 180.85 ± 38.01 mg/dl, 67.22 ± 7.43mg/dl and 336.13 ± 37.19 mg/dl respectively. There is a positive correlation between age and TC, LDL, VLDL and triglyceride with r values 4.7, 0. 31, 0.25 and 0.26 respectively. HDL is negatively correlated with age with r value -.41.

Table 3: Lipid profile and blood glucose level in DDM group with history of DM < 5 yrs. (n=18)

	Mean (mg/dl)	SD	SEM	R values
FBS	185.5000	28.86734	6.80410	0.301
PPBS	246.3889	47.95603	11.30335	0.138
TC	276.4444	47.47782	11.19063	0.242
HDL	29.9444	2.60028	.61289	-0.315
LDL	175.4667	45.81528	10.79877	0.228
VLDL	64.8000	6.64353	1.56589	0.319
TG	324.0000	33.21764	7.82947	0.412

As shown in table 3 mean FBS and RBS levels were 185.50 ± 28.867mg/dl and 246.38 ± 47.95 mg /dl respectively in DDM < 5 yrs group. Mean TC, HDL, LDL, VLDL and triglyceride level were 276.4444 ± 47.47782mg/dl, 29.9444 ± 2.60028mg/dl, 175.4667 ± 45.81528mg/dl, 64.8000 ± 6.64353 mg/dl and 324.0000 ± 33.21764 mg/dl respectively. There is a positive correlation between age and TC, LDL, VLDL and triglyceride with r values 0.242, 0.228, 0.319 and 0.412 respectively. HDL is negatively correlated with age with r value -0.315.

Table 4: Lipid profile and blood glucose levels in DDM group with history of DM > 5 yrs. (n=18)

	Mean (mg/dl)	SD	SEM	R value
FBS	219.7222	51.53047	12.14585	0.263
PPBS	291.0556	52.79090	12.44293	0.088
TC	286.8333	29.49826	6.95281	0.234
HDL	31.2222	2.39007	.56334	-0.425
LDL	186.2333	28.54415	6.72792	0.345
VLDL	69.6556	7.57202	1.78474	0.305
TG	348.2778	37.86012	8.92372	0.305

As shown in table 4 mean FBS and PPBS levels were 219.7222 ± 51.53047mg/dl and 291.0556± 52.79090 mg /dl respectively in DDM > 5 yrs group. Mean TC, HDL, LDL, VLDL and triglyceride level were 286.8333 ± 29.49826 mg/dl, 31.2222± 2.39007 mg/dl, 186.2333 ± 28.54415 mg/dl, 69.6556 ± 7.57202 mg/dl and 348.2778 ± 37.86012 mg/dl respectively. There is a positive correlation between age and TC, LDL, VLDL and triglyceride with r values 0.234, 0.345, 0.305 and 0.305 respectively. HDL was negatively correlated with age with r value -0.42.

Table 5: Comparison of Lipid profile and blood glucose level in subjects of DDM group with history of DM < 5 yrs and > 5 yrs. (n=18)

		Mean (mg/dl)	SD	P Values
FBS	DDM< 5 yrs	185.5000	28.86734	0.002
	DDM >5 yrs	219.7222	51.53047	
PPBS	DDM< 5 yrs	246.3889	47.95603	0.012
	DDM >5 yrs	291.0556	52.79090	
TC	DDM< 5 yrs	276.4444	47.47782	0.031
	DDM >5 yrs	286.8333	29.49826	
HDL	DDM < 5 yrs	29.9444	2.60028	0.064
	DDM >5 yrs	31.2222	2.39007	
LDL	DDM<5 yrs	175.4667	45.81528	0.032
	DDM >5 yrs	186.2333	28.54415	
VLDL	DDM<5 yrs	64.8000	6.64353	0.023
	DDM >5 yrs	69.6556	7.57202	
TG	DDM< yrs	324.000	37.86012	0.031
	DDM >5 yrs	348.2778	33.21764	

Table 5 shows significant higher values of PPBS and FBS in DDM with DM > 5 yrs as compared to DDM with DM < 5 yrs. Levels of all parameters of lipid profile except HDL were significantly higher ($p < 0.05$) in DDM with DM > 5 yrs as compared to DDM with DM < 5 yrs.

Table 6: Blood sugar level and lipid profile in control group (Y). (n=36)

	Mean (mg/dl)	SD	SEM	R values
FBS	90.8056	11.69815	1.94969	0.287
PPBS	110.4444	5.47954	.91326	0.143
TC	181.0000	10.92049	1.82008	0.116
HDL	52.4444	2.93203	.48867	-0.049
LDL	100.8278	9.95971	1.65995	0.104
VLDL	28.8944	1.37029	.22838	0.142
TG	144.4722	6.85143	1.14190	0.142

As shown in table 6 mean FBS and PPBS levels were 90.8056± 11.69815 mg/dl and 110.4444 ± 5.47954mg/dl respectively in control group. Mean TC, HDL, LDL, VLDL and triglyceride level were 181.00 ± 10.92049 mg/dl, 52.4444 ± 2.93203 mg/dl, 100.8278 ± 9.95971 mg/dl, 28.8944 ± 1.37029 mg/dl and 144.4722 ± 6.85143 mg/dl respectively. There is a positive correlation between age and TC, LDL, VLDL and triglyceride with r values 0.116, 0.104, 0.142 and 0.142 respectively. HDL is negatively correlated with age with r value -0.049.

Table 7: Comparison of DDM group with control

		Mean (mg/dl)	**SD**	**SEM**	**P Values**
FBS	DDM	202.6111	44.67296	7.44549	0.00
	control	90.8056	11.69815	1.94969	
PPBS	DDM	268.7222	54.62318	9.10386	0.00
	control	110.4444	5.47954	.91326	
TC	DDM	281.6389	39.30987	6.55164	0.01
	control	181.0000	10.92049	1.82008	
HDL	DDM	30.5833	2.54530	.42422	0.002
	control	52.4444	2.93203	.48867	
LDL	DDM	180.8500	38.01429	6.33572	0.00
	control	100.8278	9.95971	1.65995	
VLDL	DDM	67.2278	7.43969	.23995	0.00
	control	28.8944	1.37029	.22838	
TG	DDM	336.1389	37.19843	6.19974	0.00
	control	144.4722	6.85143	1.14190	

As shown in table 7 mean FBS and RBS levels were 202.6 mg/dl and 268.72 mg/dl respectively in DDM group. While mean FBS and PPBS levels were 90.8056± 11.69815 mg/dl and 110.4444 ± 5.47954 mg/dl respectively in control group. Mean TC, HDL, LDL, VLDL and triglyceride level were 281.6389 ± 39.09 mg/dl, 30.58 ± 2.54mg/dl, 180.85 ± 38.01 mg/dl, 67.22 ± 7.43mg/dl and 336.13± 37.19 mg/dl respectively. Mean TC, HDL, LDL, VLDL and triglyceride level were 181.00 ± 10.92049 mg/dl, 52.4444 ± 2.93203 mg/dl, 100.8278 ± 9.95971 mg/dl, 28.8944 ± 1.37029 mg/dl and 144.4722 ± 6.85143 mg/dl respectively. All these parameters were significantly higher in DDM group as compared to control group.

Discussion

Diabetes Mellitus remain a mass puzzle among the scientist for a long time and is still a major threat to human health in 21st century [10]. Changes in human behaviour and life style resulted in dramatic increase in incidence of diabetes worldwide particularly to type 2 diabetes [11]. Various factors are known to affect the lipid profile like age, sex, BMI, diabetic state etc. Dyslipidemia has various deleterious effects on health like increased incidence of atherosclerosis and myocardial infarction. When associated with diabetes mellitus effects of dyslipidemia worsen many times. As there are limited studies available on age related change in lipid profile in diabetic subjects, this study was conducted to find out correlation of age with dyslipidemias.

This present cross sectional case control study was carried out on middle age group (40-50 years) 36patients of type 2 diabetes mellitus with dyslipidemia as cases and 36 as controls. In this present study, table 1 shows demographic details of cases and controls. Mean age of overall case group was 56.51 ± 0.865 yrs with sex ratio 1.57. Mean age of DDM patients were 46.02 ± 0.422 years. While sex ratio in this case group was 1.25. Mean age of control group was 35.19 ± o.437 years, and sex ratio was 2.60. Higher incidence of diabetes mellitus in males is consistent with the findings of many authors who stat that there is increased prevalence of diabetes in males specially in older age groups [12].

As evident from table 2, TC, LDL VLDL and triglyceride increases with age while HDL levels decreases with age in DDM group. There is a corresponding positive correlation between age and TC, LDL, VLDL and triglyceride with r values 4.7,0.31, 0.25 and 0.26 respectively. HDL is negatively correlated with age with r value -.41.

Our findings were consistent with findings of studies by Miller *et al* [13] and The Framingham Study [14] They established that serum total cholesterol increases with age secondary to increasing LDL-C. Low-density lipoprotein cholesterol increases more rapidly with age. This increase is primarily due to a decrease in lipid metabolism which, in turn, is secondary to either a decrease in the number of functioning LDL receptors in the hepatic and extra hepatic cells or the result of alterations in the function of LDL-C receptors with age. These changes in lipid metabolism play an important role in the increased incidence of CVD in older adults.

Table 3, 4 and 5 show significant higher values of PPBS and FBS in DDM with DM > 5 yrs as compared to DDM with DM < 5 yrs. Levels of all parameters of lipid profile except HDL were significantly higher ($p < 0.05$) in DDM with DM > 5 yrs as compared to DDM with DM < 5 yrs. This signifies that changes in lipid profile is duration dependent. Derangement in lipid profile become worse with time.

Our findings were also supported by the study of Walter *et al*. [15] Who has found that the blood- lipid profile worsened with increasing age. Specifically, triglycerides, total cholesterol, and LDL cholesterol increased within each age-group (31, 16, and 15%, respectively). No consistent effect of age was noted on HDL cholesterol and the total cholesterol–to–HDL cholesterol ratio.

As shown in table 6 in control group mean FBS and PPBS levels were 90.8056± 11.69815 mg/dl and 110.4444 ± 5.47954mg/dl respectively within normal range. Mean TC, HDL, LDL, VLDL and triglyceride level were also within normal range. But still there is a positive correlation between age and TC, LDL, VLDL and triglyceride with r values. 116,.104,.142 and.142 respectively. HDL is negatively correlated with age with r value -.049. Though correlations of lipid profile with age were not strong in control group.

As shown in table 7, mean triglyceride level was significantly higher in DDM group as compared to control group (336.13± 37.19 mg/dl vs 144.47 ± 6.85 mg/dl). Whare as HDL levels were significantly low (30.58 ± 2.54mg/dl 52.4444 ± 2.93203 mg/dl) in DDM group

Our findings were supported by the study of Kannel *et al*. [16] who were shown that the prevalence of high plasma triglyceride levels in individuals with diabetes mellitus was significantly higher than in those without diabetes mellitus. They were also observed the prevalence of low HDL cholesterol level in those with diabetes mellitus was almost twice as high as the prevalence in nondiabetic individuals

Summary

1. All constituents of lipid profile were deranged in diabetic patients.
2. Total cholesterol, LDL, VLDL and triglyceride levels were increased in middle age groups (DDM) of diabetic patients as compared to normal control subjects.
3. HDL level was decreased in diabetes dyslipidemic patients (DDM) as compared with healthy groups.
4. Age as well as diabetic state was affecting factors of lipid profile.

5. Duration of diabetes mellitus had also a deleterious effect on lipid profile which was evident from the comparison of subjects having history of DM more than 5 years and less than 5 years.

Conclusion

This present study was concluded that diabetic state had deleterious effects on lipid profile. All constituent of lipid profile was increased in patients with type 2 diabetes mellitus except HDL which was a negative trend with advancing age of patients with diabetes mellitus as compared non diabetes mellitus healthy subjects. Hence, as state of diabetes mellitus was increased, constituent of lipid profile were also increased except HDL.

References

1. Harrison`s principles of Internal medicine:vol II 17th ed:2166-67.
2. Alberti KG, Bennett P, Pan XR, Li GW, Hu YH, Wang JX Review Follow-up report on the diagnosis of diabetes mellitus. Diabetes Care. 1997; 20(7):1183-97.
3. Park`s text book of Preventive and Social Medicine 21st edition; Diabetes Mellitus: 362-366.
4. Kumar V, Cotran SR, Robbins SL. Basic Pathology; Insulin Resistence Pancreas, 647-648.
5. Joe M. Chehade, Margaret Gladysz, Arshag D. Mooradian, Dyslipidemia in Type 2 Diabetes: Prevalence, Pathophysiology, and Management. Drugs. 2013; 73(4):327-339.
6. Ferrannini E, Barrett EJ, Bevilacqua S, DeFronzo RA. Effect of Fatty acids on glucose Production and Utilization in man. J Clin Invest. 1983; 72:1737-47.
7. WHO study group. Diabetes Mellitus Technical Report Series 727 Geneva World health organization, 1985.
8. Friedewald WT, Levy RI, Fredrickson DS. Estimation of the concentration of low-density lipoprotein cholesterol in plasma, without use of the preparative ultracentrifuge. Clin Chem. 1972; 18(6):499-502.
9. Volpi N, Tarugi P. Improvement in the high-performance liquid chromatography malondialdehyde level determination in normal human plasma. Journal of Chromatography B: Biomedical Sciences and Applications. 1998; 713(2):433-7.
10. Zimmet Globalization. cocacolization and the chronic disease epidemic ; can the dooms day scenario be averted? J. Intern. Med 247: 301-310 Zimmet P. Diabetes epidemiology as a trigger to diabetes research. Diabetologia. 1999; 42:499-518.
11. Zimmet P. Diabetes epidemiology as a trigger to diabetes research. Diabetologia. 1999; 42:499-518.
12. Arshag Mooradian D. Dyslipidemia in type 2 diabetes mellitus. Nature Clinical Practice Endocrinology & Metabolism. 2009; 5:150-159.
13. Miller GJ, Miller NE. Plasma-high-density-lipoprotein concentration and development of ischaemic heart-disease. Lancet.1975; (7897):16-19.
14. Gordon T, Castelli WP, Hjortland MC, *et al*. High density lipoprotein as a protective factor against coronary heart disease The FraminghamStudy. Am J Med. 1977; 62(5).
15. Walter F. DeNino Andre Tchern of, Isabelle J. Dionne, Michael J. Toth, Philip A. Ades, Cynthia K. Sites, and Eric T. Poehlman, S ensitivity and Plasma Lipids in Healthy Nonobese Women, Diabetes Care. 2001; 24(5):925-932.
16. Walter F. DeNino. Andre Tchern of, Isabelle J. Dionne, Michael J. Toth, Philip A. Ades, Cynthia K. Sites, and Eric T. Poehlman, S ensitivity and Plasma Lipids in Healthy Nonobese Women, Diabetes Care. 2001; 24(5):925-932.