



Study of Fasting and Postprandial Lipid Profiles in Type 2 Diabetes Mellitus

Authors

S.Pravin^{1*}, R.Aswinth², S.Sudharsan³

¹Post Graduate, ²Assistant Professor, ³Professor

Department of General Medicine, Rajah Muthiah Medical College Hospital, Chidambaram,
Tamil Nadu, India

*Corresponding Author

S.Pravin

Abstract

Background and Objectives: Type 2 diabetes mellitus is associated with the development of premature atherosclerosis and a higher cardiovascular morbidity and mortality. Diabetic dyslipidemia is believed to play an important role in the pathogenesis of accelerated atherosclerosis in this condition. It is being increasingly believed that atherosclerosis is a postprandial phenomenon as at least with respect to lipids, we are in the postprandial phase for most of the day. High postprandial triglycerides have shown a strong and independent association with CAD. Hence this study is being carried out to assess the characteristics of postprandial dyslipidaemia in types 2 diabetes mellitus in comparison with the fasting lipid levels in diabetics and controls.

Methodology: This was an observational study which included the patients admitted in Raja Muthiah Medical College Hospital, Chidambaram, Tamilnadu. The study included 50 patients with type 2 diabetes mellitus meeting the inclusion criteria and were compared with 50 age and sex matched healthy controls, fulfilling the inclusion and exclusion criteria.

Method of Collection of Data: Data for the proposed study was collected in a pretested proforma. Detailed history and physical examination of all the cases and controls was done. Fasting and Post prandial lipid levels were estimated in all the cases and controls. Blood was collected from patients after an overnight (12-hour) fast and six hour postprandial (after a standard meal) for lipid profile measurements.

Results: The majority of cases were in the age group of 61-70 years. All the cases in the fasting state had a raised triglyceride (mean 172.92 ± 75.51 mg/dL) level, raised VLDL-C (mean 37.76 ± 20.01 mg/dL) level, decreased HDL-C (mean 33.44 ± 11.99 mg/dL) level, normal total cholesterol (mean 176.36 ± 52.43 mg/dL) level and normal LDL-C (mean 101.16 ± 38.17 mg/dL) levels compared to the control group. In the post prandial state the diabetics had a significant increase in the post prandial triglyceride level (mean 232.52 ± 105.08 mg/dL), decrease in the HDL-C level (mean 30.96 ± 11.15 mg/dL) compared to the fasting state whereas in the control group there was no significant increase in the post prandial lipid levels compared to the fasting state.

Conclusion: The dyslipidemia of Type 2 DM is characterised mainly of raised triglyceride levels, raised VLDL-C Levels and decreased HDL-C levels. In the post prandial state there was significant hyper-triglyceridaemia and decreased HDL-C level in diabetics when compared to that of the controls.

Keywords: Dyslipidemia, atherosclerosis, hyper-triglyceridaemia, postprandial dyslipidemia.

Introduction

Diabetes mellitus (DM) refers to a group of common metabolic disorders characterised by the distinct phenotype of hyperglycemia. The two broad categories of DM are designated as type 1 diabetes and type 2 diabetes. Both types of diabetes are preceded by the period of abnormal glucose homeostasis.

Type 2 DM is preceded by a phase of abnormal glucose homeostasis defined as impaired fasting glucose (IFG) or impaired glucose tolerance (IGT). Dyslipidemia that is associated with type 2 diabetes plays a vital role in the pathogenesis of accelerated atherosclerosis in that population. The most important features of this dyslipidemia include an elevated very low density lipoproteins (VLDL) and total triglycerides (TGs) and a decreased high density lipoproteins (HDL) concentration in the serum. While fasting hyper triglyceridemia plays an important role in atherosclerosis, particularly in people with diabetes mellitus, this association has been less consistent and fasting HDL-C appears to be a far more significant determinant of atherosclerosis. However, when TGs are analysed in the postprandial state, they emerge as an independent and stronger coronary risk factors than HDL-C. Postprandial hypertriglyceridemia is shown to be associated with asymptomatic and symptomatic macrovascular disease in both normo- and hypertriglyceridemic groups and such abnormalities have been reported in people with type 2 diabetes and hence the increased risk of atherosclerosis among them, might therefore be correlated to the higher degree of postprandial triglyceridemia. Earlier studies clearly demonstrate the presence of hypertriglyceridemia in the postprandial state among the diabetic subjects, irrespective of whether fasting triglyceride levels were high or low.

It is not clearly known whether the patients with type 2 diabetes with macro vascular disease have greater abnormalities of the triglyceride

metabolism in the post prandial state than those without.

Aim

To study the fasting and postprandial lipid abnormalities in Type 2 DM

Objectives

1. To assess the pattern of fasting and postprandial dyslipidemia in Type 2 DM
2. To compare the fasting and postprandial lipid profiles in Type 2 DM and age cum sex matched Controls

Materials and Methods

This analytical study was conducted from Sep 2017 to Oct 2019. During this period, the 50 patients with Type2 DM and 50 age and sex matched healthy patients as controls in RMMCH has been studied.

Inclusion Criteria

All patients with Type 2 DM and same age and sex matched healthy controls. Diabetes diagnosed according to American Diabetes Association Criteria.

- FBS \geq 126 mg /dl, PPBS \geq 200mg /dl.
- Total cholesterol $>$ 200mg /dl
- Triglycerides $>$ 150mg /dl
- Low density lipoprotein (LDL) $>$ 100mg /dl
- High density lipoprotein (HDL) $<$ 50mg /dl
- Very low density lipoprotein (VLDL) $>$ 30mg /dl
- LDL/HDL ratio $>$ 3.5

Exclusion Criteria

- Type1 DM
- Medications that affect lipid levels
- Hepatic disease
- Hypothyroidism
- Nephrotic range proteinuria $>$ 3gms/day
- Smoking
- Alcoholism

Method of collection of data

A detailed proforma was filled up for each patient, which included age, sex, IP number, detailed

history, past and personal history, medication history. A detailed clinical examination was done. Laboratory parameters including fasting and postprandial blood glucose, renal function tests, liver function tests, ECG and routine urine examination. Fasting and Post prandial lipid profile which included serum total cholesterol, serum triglycerides, LDL cholesterol, HDL cholesterol and VLDL were estimated in all the cases and controls. Blood was collected from patients after an overnight (12-hour) fast and six-

hour postprandial (after a standard meal) for lipid profile measurements.

Statistical Analysis

The following statistical methods were employed

1. Descriptive statistics
2. T test – Independent samples
3. T test pair samples
4. Repeated measure ANOVA
5. Product-moment correlation

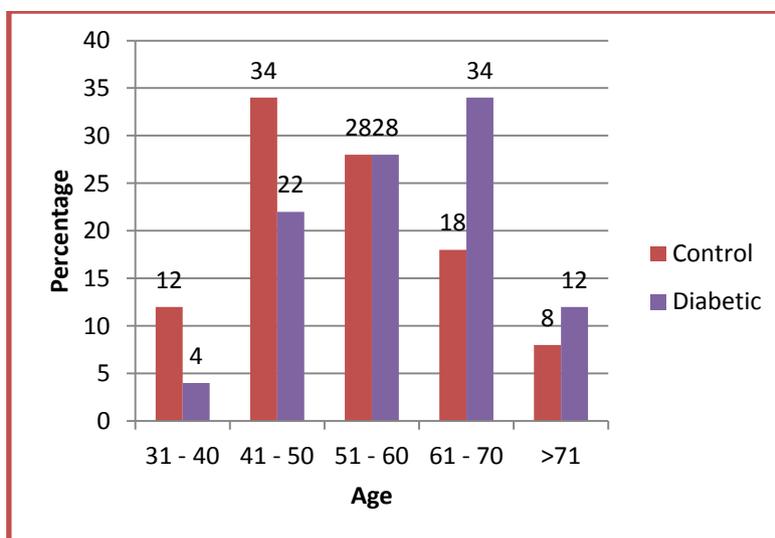
Using SPSS for windows

Results

Age distribution of the cases and controls

Age	Control		Diabetic		Total
	N	%	N	%	
31 - 40	6	12	2	4	8
41 - 50	17	34	11	22	28
51 - 60	14	28	14	28	28
61 - 70	9	18	17	34	26
>71	4	8	6	12	10
Total	50	100	50	100	100

Showing the age distribution of the cases and controls

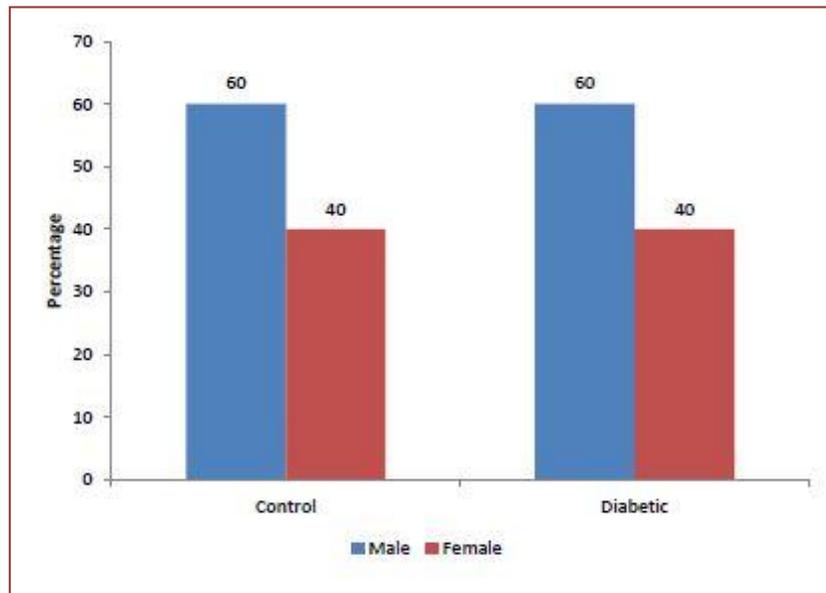


The majority of cases were in the age group of 61-70 years.

Sex wise distribution of the cases and controls

Sex	Control		Diabetic		Total
	N	%	N	%	
Male	30	60	30	60	60
Female	20	40	20	40	40
Total	50	100	50	100	100

Showing the sex wise distribution of the cases and controls

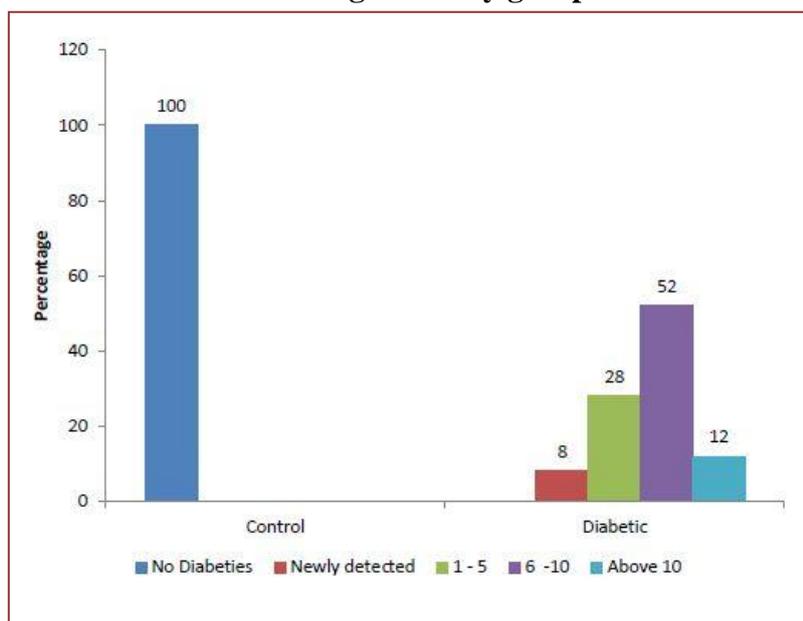


In this study, 60 percent were males and 40 percent were females, in both the groups.

Duration of diabetes among the study group

DM	Control		Diabetic		Total
	N	%	N	%	
No Diabetes	50	100	-	-	-
Newly detected	-	-	4	8	54
1 - 5	-	-	14	28	14
6 - 10	-	-	26	52	26
Above 10	-	-	6	12	6
Total	50	100	50	100	100

Graph showing the duration of diabetes among the study group



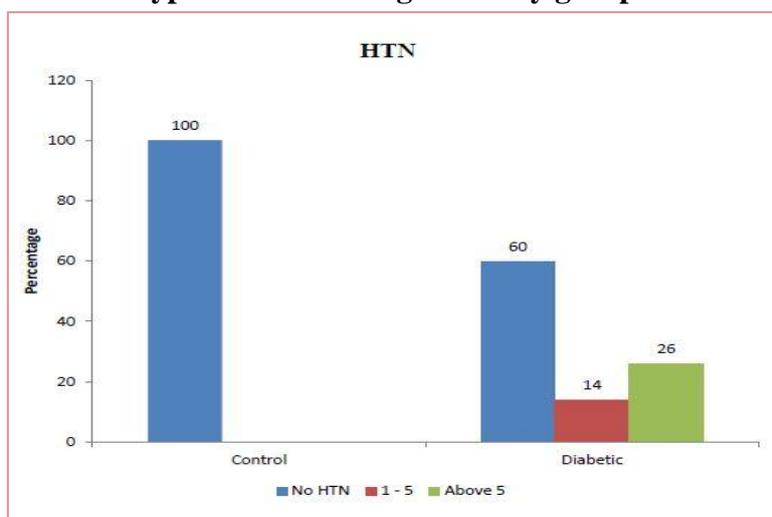
In this study 8% of the cases were newly detected type 2 diabetics, whereas 28% of the cases had diabetes for 1 - 5 years, 52% had diabetes for 6 –

10 years and 12 % had diabetes for more than 10 years. In the control group none of the patients had type 2 diabetes mellitus.

Duration of hypertension among the study group

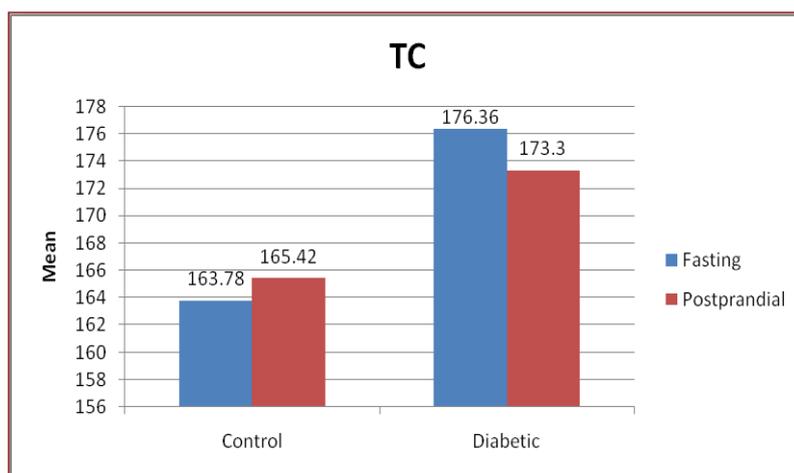
HTN	Control		Diabetic		Total
	N	%	N	%	
No HTN	50	100	30	60	80
1 - 5	-	-	7	14	7
Above 5	-	-	13	26	13
Total	50	100	50	100	100

Graph showing the duration of hypertension among the study group



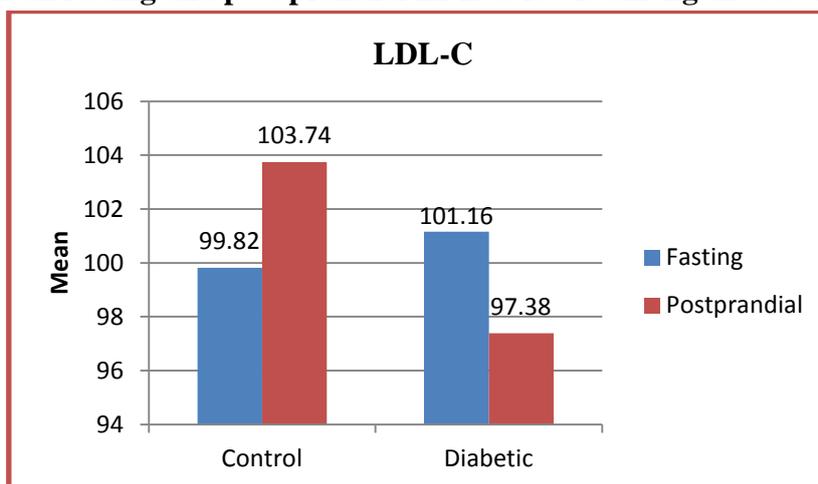
In this study, 40 % of diabetics had hypertension whereas 60 % of diabetics were normotensive. None of the controls, were found to have hypertension.

Comparison of the mean fasting and post prandial total Cholesterol levels among the cases and controls



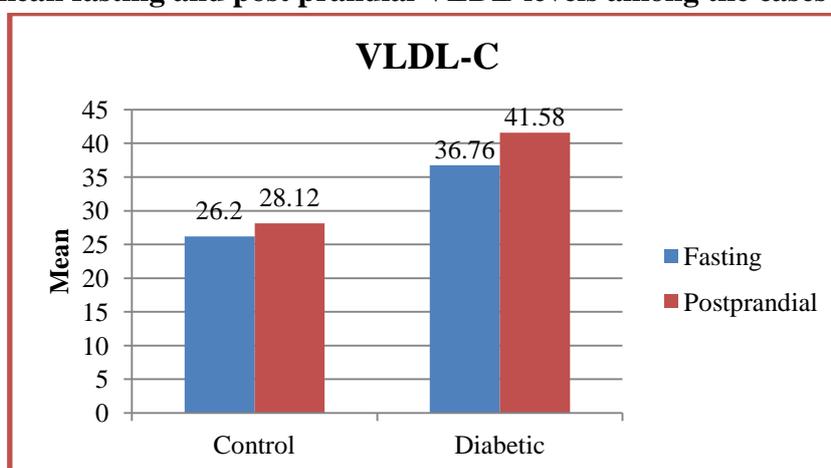
There was no significant difference in the TC level in the cases compared to that of the controls in both the fasting and post prandial state.

Comparison of the mean fasting and post prandial LDL-C levels among the cases and controls



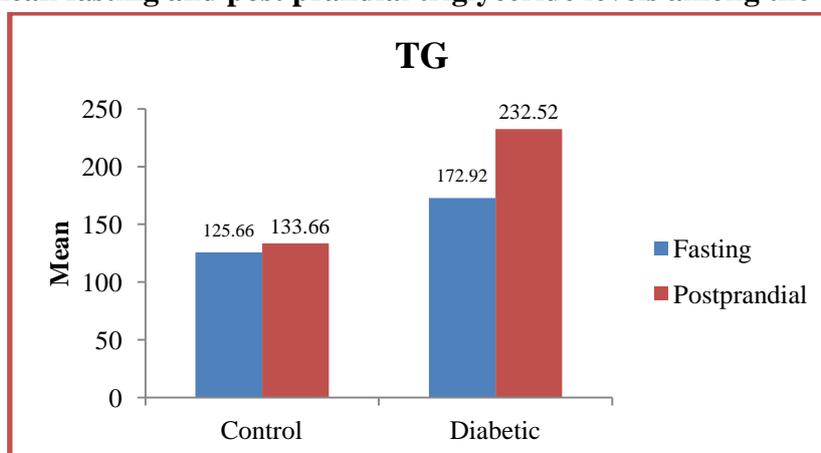
There was a no significant increase in the LDL-C level among the cases compared to that of the controls in both the fasting and post prandial state.

Comparison of the mean fasting and post prandial VLDL-levels among the cases and controls



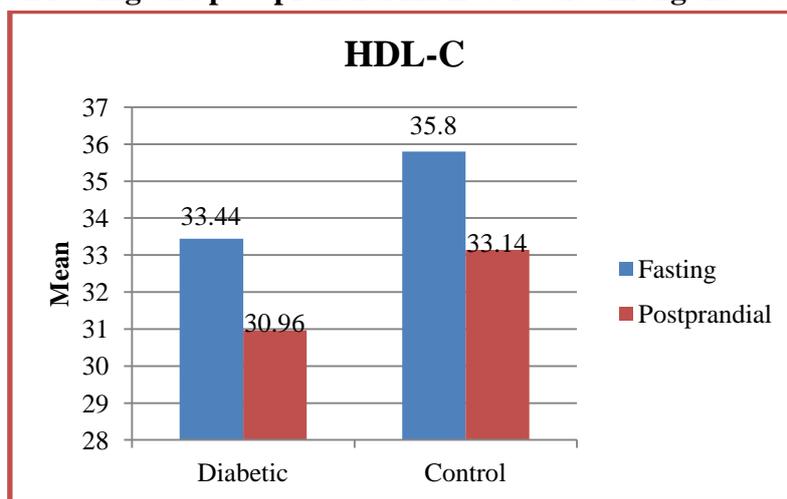
The cases with diabetes were found to have elevated VLDL-C levels when compared with that of controls in both fasting and post prandial.

Comparison of the mean fasting and post prandial triglyceride levels among the cases and controls



In the fasting state cases with diabetes were found to have elevated triglyceride levels when compared with that of controls. There was a significant increase in the post prandial TG level in patients with diabetes.

Comparison of the mean fasting and post prandial HDL-C levels among the cases and controls



Though the HDL-C levels in diabetics was low, there was no significant difference in the HDL-C levels in both the cases and controls in the

fasting state. In the post prandial state, there was a significant decrease in the HDL-C level in the cases compared to that of the controls.

Comparison of the mean fasting and post prandial lipid levels among the cases and controls

		Group	N	Mean	SD	P
FASTING	TC	Control	50	163.78	36.29	0.166
		Diabetic	50	176.36	52.43	
	HDL-C	Control	50	35.80	11.42	0.316
		Diabetic	50	33.44	11.99	
	LDL-C	Control	50	99.82	36.21	0.857
		Diabetic	50	101.16	38.17	
	VLDL-C	Control	50	26.20	13.41	0.003
		Diabetic	50	36.76	20.01	
	TG	Control	50	125.66	49.55	0.000
		Diabetic	50	172.92	75.51	
POST PRANDIAL	TC	Control	50	165.42	35.36	0.323
		Diabetic	50	173.30	43.56	
	HDL-C	Control	50	33.14	11.04	0.04
		Diabetic	50	30.96	11.15	
	LDL-C	Control	50	103.74	35.60	0.383
		Diabetic	50	97.38	36.93	
	VLDL-C	Control	50	28.12	14.00	0.000
		Diabetic	50	41.58	19.82	
	TG	Control	50	133.66	48.79	0.000
		Diabetic	50	232.52	105.08	

Discussion

In the present study, fasting and post prandial lipid profile was done in 50 patients with type 2 diabetes mellitus and was compared with the

fasting and post prandial lipid profile in 50 healthy controls, age and sex matched, fulfilling the inclusion and exclusion criteria.

Age distribution of cases and controls

In the present study, the study group constituted cases from age 31 to 85 years. The majority of cases were in the age group of 61-70 years which constituted 34% of the total; Followed by persons in the age group 51-60 years who constituted 28% of the total study.

Sex wise distribution of the cases and controls

In this study, 60% of the study group were males and 40% of the study group were females. Similarly the control group consisted of 60% males and 40% females age matched with the study group.

Duration of diabetes among the study group

In this study 8% of the cases were newly detected with type 2 diabetes mellitus. The duration of diabetes in 28% of cases was between 1 - 5 years, 52% between 6- 10 years and 12% of cases had diabetes for more than 10 years. In the control group none of the patients had diabetes.

Prevalence of hypertension among the study group

In the present study, the prevalence of hypertension among the cases was 40% and among the controls none of them had hypertension. In the study done by Sumesh raj et al the prevalence of hypertension was seen to be significantly higher in the cases (28%), which is consistent with our study.

Total Cholesterol levels among the cases and controls

In this study, in the fasting state, 24% of cases had total cholesterol levels of >200 mg/dl as compared with the controls where 16% of them had total cholesterol of >200 mg/dl. This association has a p value of 0.146, which is statistically not significant. There was no significant increase in the post prandial TC level in the cases compared to that of the controls. Similar observations were made in the studies done by SV Madhu et al.

LDL-C levels among the cases and controls

In this study, in the fasting state, 58% of cases had LDL-C levels of <100 mg/dl as compared with that of the control group where 46% of controls

had LDL-C of <100 mg/dl. This association has a p value of 0.266, which is statistically not significant.

In the Strong Heart Study done by Howard BV et al it was shown that, in American Indians, LDL cholesterol level was the most significant predictor of increased CHD, despite an average LDL cholesterol level of approximately 115 mg/dL in diabetics. In the same study, LDL was a strong predictor of CHD at levels as low as 70mg/dl.

In our study though the diabetics had a decreased LDL-C in the post prandial state, it was statistically insignificant. This does not correlate with a study done by Lund et al which showed that in diabetics, LDL-C decreased significantly post prandially ($p < 0.005$).

VLDL-C levels among the cases and controls

In this study, in the fasting state 28% of cases had total VLDL-C levels of >40 mg/dl as compared with that of the control group where only 8% of them had VLDL-C levels of >40mg/dl. This association has p value of 0.029 which is statistically significant. Thus cases with diabetes were found to have elevated VLDL-C levels when compared with that of controls. This correlates with the study done by Angela A Rivellesse et al. Similarly, in the post prandial state, 46% of cases had VLDL-C levels of >40 mg/dl as compared with that of control group, where 14% of them had VLDL-C levels of >40 mg/dl. This association has a p value of 0.001 which is statistically significant. Thus cases with diabetes were found to have elevated post prandial VLDL-C levels when compared with that of controls. This does not correlate with the study done by Angela A Rivellesse et al.

Triglyceride levels among the cases and controls

In this study, in the fasting state 56% of the cases had total TG levels of >150 mg/dl as compared with that of control group wherein only 30% of them had TG levels of >150 mg/dl. This association has a p value of 0.021, which is statistically significant.

Thus in the fasting state cases with diabetes were found to have elevated triglyceride levels when compared with that of the controls. This correlates with the studies done by Sumesh raj et al, SV Madhu et al & Angela A Rivellesse et al.

There was a significant increase in the post prandial TG level in the cases compared to that of the controls. Similar observations were made in the studies done by SV Madhu et al, Sumesh raj et al ($p < 0.01$), & Angela A Rivellesse et al.

HDL-C levels among the cases and controls

In this study, in the fasting state 70% of the cases had HDL-C levels of < 35 mg/dl as compared with that of control group wherein 60% of them had HDL-C levels of < 35 mg/dl.

This association has a p value > 0.05 , which is not significant. Hence, there was no significant difference in the HDL-C levels in both the cases in the fasting state. This correlates with the study done by Sumesh raj et al which showed no significant difference in the HDL-C levels in the diabetics and controls. This does not correlate with the study done by SV Madhu et al which showed that diabetics had lower HDL-C levels compared to that of the controls.

This association has a p value of 0.04 for post prandial state which is statistically significant. Hence, there was a significant decrease in the post prandial HDL-C level in the cases compared to that of the controls. Similar observations were made in the studies done by SV Madhu et al.

Conclusion

- The dyslipidemia of Type 2 DM is characterized mainly by raised triglyceride levels, raised VLDL-C Levels and decreased HDL-C levels.
- In the post prandial state there was significant hyper-triglyceridaemia and decreased HDL-C levels in diabetics when compared to that of the control.

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