

A Comparative Study on the Fasting and Postprandial Dyslipidaemia in Type 2 Diabetes Mellitus

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Abstract

Background: The prevalence of type 2 DM is increasing worldwide, more so in South Asian population due to various factors like, high degree of genetic predisposition and high susceptibility to environmental factor, characterized by a high BMI, high upper body adiposity, a high body fat percentage and a high level of insulin resistance. The dyslipidemia in type 2 DM is different than in non-diabetics, as it has been proposed that composition of lipid particles in diabetic dyslipidemia is more atherogenic than other types of dyslipidemia.

Aim: To compare post prandial lipid levels with fasting lipid levels in type 2 diabetes mellitus.

Materials and Methods: This was a prospective study conducted in a tertiary care hospital in South India from March 2011 to March 2012. The study was approved by the institutional ethics committee. Informed consent was taken from all the included subjects. Blood was drawn from the subjects after 12 hours fasting and 6 hours after meals with staple food for two days. Estimation of lipid profile was done using enzymatic method. The significance of the difference between the groups was assessed by unpaired Student's t-test or Mann Whitney U tests, between cases and controls and P values of <0.05 were considered as statistically significant.

Results: The lipid profile (both fasting and post prandial) was significantly altered in individuals with type 2 diabetes when compared with controls. The postprandial lipid parameters were significantly increased in the type 2 DM subjects as compared to the fasting lipid parameters and the postprandial HDL level was significantly decreased as compared to the fasting HDL level.

Conclusion: It is important to include postprandial lipid profile, in addition to the fasting lipid profile, which helps in better cardiovascular risk assessment in type 2 diabetes mellitus. Appropriate lifestyle changes, such as weight reduction and increased physical activity should be the first step followed by medication with lipid lowering drugs in controlling dyslipidemia in type 2 diabetes mellitus.

Key Words: Dyslipidemia, Type 2 Diabetes Mellitus, Post Prandial Dyslipidemia, Metabolic Syndrome

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Introduction

Diabetes mellitus (DM) is a metabolic disorder characterized by deficiency in insulin secretion and/or insulin action associated with chronic hyperglycemia and disturbances of carbohydrate, lipid and protein metabolism.⁽¹⁾ The prevalence of type 2 DM is increasing worldwide, more so in South Asian population due to various factors like, high degree of genetic predisposition high susceptibility to environmental factor, characterized by a high BMI, high upper body adiposity, a high body fat percentage and a high level of insulin resistance.⁽²⁾

Insulin resistance or deficiency affects key enzymes and pathways in lipid metabolism leading to lipid abnormalities in DM.⁽³⁾ The term diabetic dyslipidemia comprises a triad of raised triglycerides

(TG), reduced high density lipoprotein cholesterol (HDL-C) and excess of small, dense low density lipoprotein cholesterol (LDL-C) and very low density lipoprotein cholesterol (VLDL-C) particles.⁽¹⁾ The dyslipidemia in type 2 DM is different than in non-diabetics, as it has been proposed that composition of lipid particles in diabetic dyslipidemia is more atherogenic than other types of dyslipidemia.⁽⁴⁾ Dyslipidemia to a large extent contributes to the risk of coronary artery disease in diabetic patients and the determination of the serum lipid levels in people with diabetes is now considered as a standard of the diabetes care.⁽⁵⁾

The high cardiovascular mortality associated with type 2 DM is due to a prolonged, exaggerated, postprandial dyslipidemia.^(6,7) A literature search reveals that there are studies conducted on dyslipidemia in type 2 DM, but majority of these studies have included only pre-prandial lipid levels. There are very few studies which have included post-prandial lipid levels in type 2 DM, hence the present study aims to compare post-prandial lipid with fasting lipid levels in individuals with type 2 diabetes mellitus.

Material and Methods

Study design and population: This was a prospective study conducted in a tertiary care hospital in South India from March 2011 to March 2012. The study was approved by the institutional ethics committee. A total of 150 individuals were included in study (sample size was derived by keeping power of the study >0.8). Informed consent was taken from all the individuals, attending the Medicine outpatient department were screened for the following:

Inclusion criteria

1. Type 2 DM patients aged between 30-60 years who were on oral hypoglycaemic drugs.
2. Duration of diabetes of more than five years.

Exclusion criteria

1. Individuals with history of medical disorders such hypertension, hepatic, renal and cardiac disorders.
2. Individuals with Type 1 diabetes mellitus, smokers, alcoholics, family history of dyslipidemia.
3. Subjects on medications which interfere with the study, such as hypolipidemics, beta blockers and steroids.

Laboratory Investigations: Venous blood samples were collected at the enrollment visit with overnight fasting (12 hours). Fasting blood glucose was estimated by using commercially available GOD-POD kit. Serum total cholesterol (TC) and total triglycerides (TG) were estimated by an enzymatic method^(8,9) Serum high density lipo-protein (HDL) by phosphotungstate precipitation, followed by enzymatic method^(8,9) Serum low density lipo-protein (LDL) Cholesterol and very low density lipo-protein (VLDL) Cholesterol by using Friedewald's formula.⁽¹⁰⁾ TC/ HDL and LDL/HDL ratio were also calculated. All the parameters were analyzed by using a semi-automated analyzer.

Statistical analysis: All the results were expressed as means±(SD) values. The data was recorded in Microsoft excel and analyzed using SPSS software (version 15). The significance of the difference between the groups was assessed by Student's t-test, between cases and controls and p values of <0.05 were considered as statistically significant.

Results

A total of 75 controls and 75 cases were included in the final analysis. The demographic data of the subjects is shown in Table 1.

Table 1: Demographic data of the subjects

Variable	Controls	Diabetics
Number of subjects	75	75
Age (yrs)	45.3±6.18	44.5±7.78
Gender distribution(M:F)	42:33	39:36
SBP (mmHg)	132.76±6.34	136.43±7.86
DBP (mmHg)	82.23±4.65	86.23±5.76
BMI (kg/m ²)	23.8±4.56	27.1±5.42
Family history of diabetes (Yes/No)	29/46	27/48

SBP = Systolic blood pressure, DBP = Diastolic blood pressure, BMI = Body mass index
Maximum cases were males and in age group of 35-50 years.

No statistically significant difference was seen between diabetics and non-diabetics.

The fasting lipid profile of the subjects is shown in Table 2.

Table 2: Comparison of fasting lipid profile among the subjects

Lipid profile	Controls	Diabetics
TC (mg/dl)	164.45±21.86	217.45±49.63*
TGL (mg/dl)	114.65±29.97	159.27±55.23*
HDL (mg/dl)	49.87±5.16	44.56±8.16*
LDL (mg/dl)	84.16±31.12	123.84±36.22*
VLDL (mg/dl)	22.81±6.76	39.21±9.63*
TC/ HDL	5.83±2.14	5.1±1.12
LDL/HDL	3.23±0.79	2.63±0.57

TC = Total Cholesterol, TGL = Triglycerides, HDL = High density Lipoprotein, LDL = Low density Lipoprotein, VLDL = Very low density Lipoprotein cholesterol

*p≤0.01 = Highly significant

The post prandial lipid profile of the subjects is shown in Table 3.

Table 3: Post prandial lipid profile of the subjects

Lipid Profile	Controls	Diabetic
TC (mg/dl)	178.67±31.23	249.78±54.13*
TGL (mg/dl)	137.87±36.34	198.9±64.67*
HDL (mg/dl)	44.35±7.23	37.68±8.54*
LDL (mg/dl)	109.85±29.76	152.65±41.82*
VLDL (mg/dl)	25.89±5.76	37.74±8.22*
TC/ HDL	5.22±2.67	5.65±1.98
LDL/HDL	3.97±0.98	3.12±0.78

TC = Total Cholesterol, TGL = Triglycerides, HDL = High density Lipoprotein, LDL = Low density

Lipoprotein, VLDL = Very low density Lipoprotein cholesterol

* $p \leq 0.01$ = Highly significant

The comparison of fasting and post prandial lipid profile of type 2 diabetes mellitus patients is shown in Table 4.

Table 4: Comparison of fasting and post prandial lipid profile of type 2 diabetes mellitus

Lipid profile	Fasting	Postprandial
TC (mg/dl)	217.45±49.63	249.78±54.13*
TGL (mg/dl)	159.27±55.23	198.9±64.67*
HDL (mg/dl)	44.56±8.16	37.68±8.54*
LDL (mg/dl)	123.84±36.22	152.65±41.82*
VLDL (mg/dl)	39.21±9.63	37.74±8.22*
TC/HDL	5.1±1.12	5.65±1.98
LDL/HDL	2.63±0.57	3.12±0.78

TC = Total Cholesterol, TGL = Triglycerides, HDL = High density Lipoprotein, LDL = Low density Lipoprotein, VLDL = Very low density Lipoprotein cholesterol

* $p \leq 0.01$ = Highly significant

Discussion

Lipid profile and diabetes together are related to be the important predictors or metabolic disturbances such as dyslipidaemia, metabolic syndrome, hypertension, and cardiovascular diseases. Dyslipidemia as a metabolic abnormality is commonly associated with DM. In the present study, the postprandial lipid parameters i.e. TC, TG, LDL and VLDL were significantly increased in the type 2 DM subjects as compared to the fasting lipid parameters and the postprandial HDL level was significantly decreased as compared to the fasting HDL level ($P < 0.01$) [Table 4] which is in agreement with the other previous studies that reported dyslipidaemia as a common association in type 2DM.⁽¹¹⁻¹⁴⁾ Dyslipidemia as a metabolic abnormality is frequently associated with diabetes mellitus. Abnormalities in lipid metabolism have been reported in patients with diabetes mellitus accompanied by the risk of cardiovascular arteriosclerosis.⁽¹⁵⁾ Other studies were conducted on fasting lipid levels in type 2 DM, but there are very few studies conducted on post prandial lipid levels in type 2 DM. There are few studies that have reported that postprandial dyslipidaemia is more important in the pathogenesis of the vascular changes and atherosclerosis and it increases the risk of the cardiovascular events.⁽¹⁶⁻¹⁸⁾

Postprandial hypertriglyceridaemia has been linked to asymptomatic and symptomatic macrovascular diseases in both normo and hypertriglyceridaemic subjects and such abnormalities have been reported in the type 2 diabetics.⁽¹⁹⁾ One study has reported presence of postprandial

hypertriglyceridaemia among the diabetic subjects, irrespective of the fasting triglyceride levels.⁽²⁰⁾

Postprandial hypertriglyceridaemia has been linked to macrovascular diseases in both normo and hypertriglyceridaemic subjects in type 2 DM. The increased risk of atherosclerosis among them, may therefore, be related to the higher postprandial lipaemia in them.⁽²¹⁾ The postprandial dysmetabolism and the associated oxidative stress may have a link with insulin resistance and type 2 DM, thereby increasing the incidence of cardiovascular disease disproportionately.⁽²¹⁾ Another study has proposed cardiovascular disease morbidity and mortality associated with type 2 DM showed prolonged and exaggerated postprandial state.⁽²²⁾

Limitations of the Study: The study was done in a single centre and the sample size was small. Future studies should multi-centric with large sample size and should correlate the age sex and duration of diabetes on lipid profile.

Conclusion

Appropriate lifestyle changes, such as weight reduction and increased physical activity should be the first step followed by medication with lipid lowering drugs in controlling dyslipidemia in type 2 diabetes mellitus. The post-prandial lipid profile was significantly altered when compare to fasting lipid levels. It is important to include postprandial lipid profile, in addition to the fasting lipid profile, which helps in better cardiovascular risk assessment in type 2 diabetes mellitus.

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Conflict of interest: None

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