

Age Related Dyslipidemia in Type 2 Diabetes Mellitus Patients: A Hospital Based Prospective Study.Anant Prasad¹, Mithlesh Kumar Singh²¹Professor & Head, Department of Biochemistry, Sri Krishna Medical College, Muzaffarpur, Bihar, India.²Tutor, Department of Biochemistry, Sri Krishna Medical College, Muzaffarpur, Bihar, India.

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Conflict of interest: Nil

Abstract:**Objectives:** The present study was to evaluate the lipid profile and to establish the relation between serum lipid profile and effect of duration of diabetes mellitus on lipid profile in type 2 diabetes mellitus patients.**Methods:** Fasting and postprandial serum glucose were estimated quantitatively by GOD/POD technique. Total cholesterol was estimated quantitatively by CHOD-PAP technique. Serum Triacylglycerol was estimated quantitatively by GPO-ESPAS technique. High density lipoproteins (HDL-C) were 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) were calculated by subtracting serum HDL and VLDL from total serum cholesterol.**Results:** A total 68 subjects were included in this study. Out of 68 cases, 34 old age (50-60 years) patients of type 2 diabetes mellitus with dyslipidemia were enrolled in group I (DDO) and 34 old age (>60 years) patients of non-diabetic with dyslipidemia were enrolled in case group II (NDDO). FBS and PPBS were significant higher in DDO group as compared to NDDO group. Mean TC, HDL, LDL, VLDL and triglyceride level were 329.1176±39.6712 mg/dl, 30.2113±1.9887, 222.7635±37.8788 mg/dl, 69.8231±5.8564 mg/dl and 357.6543±26.7767 mg/dl respectively in NDDO group. While in DDO group mean TC, HDL, LDL, VLDL and triglyceride level were 313.8762±35.7865 mg/dl, 27.8341±1.9865 mg/dl, 212.7654±34.8765 mg/dl, 76.7861±2.0341 mg/dl and 356.9832±35.6703 mg/dl respectively. In NDDO group TC, LDL, and Triglyceride levels were higher but not statistically significant.**Conclusions:** Diabetes as well as increased age both are affected the lipid profile. TC, LDL, VLDL, and TG are increasing with advancing age and diabetes except HDL is no more increasing with advancing age. Hence, diabetes mellitus accelerates the age-related disturbance in lipid profile. So that, we should organized health check-up camp in urban as well as rural area at time to time for awareness of dyslipidemia in old age diabetic patients.**Key words:** Type 2 diabetes mellitus, old age, Dyslipidemia.This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

Dyslipidemia is one of the major risk factors for cardiovascular disease in diabetes mellitus. The characteristic features of diabetic dyslipidemia are a high plasma triglyceride concentration, low HDL cholesterol concentration and increased concentration of small dense LDL-cholesterol particles [1].

Diabetes mellitus is a severe health issue that has been dubbed "among the most important health problems of the twenty-first century". The worldwide prevalence of diabetes and poor glucose tolerance in individual has risen in current decade (Shaw, Sicree and Zimmet, 2010) [2] (Guariguata et al., 2014) [3]. The worldwide frequency of diabetes among adults aged 18 years was predicted to be 8.5 % in 2014, with around 422 million diabetics

globally. In 2012, diabetes claimed the lives of approximately 15 million people (da Rocha Fernandes, 2016) [4].

Diabetes mellitus is an endocrine disorder which is characterized by metabolic abnormalities with micro and macrovascular complications which cause significant morbidity and mortality [5]. India is one of the rapidly developing countries standing in second highest diabetes prevalence in the world which could be due to rapid urbanization that brought along with it a sedentary lifestyle is an important factor inducing diabetes mellitus [5, 6]. According to a study in 2011, the estimated number of patients with diabetes in India was 62.4 million which is projected to rise to a staggering 101.2 million by 2030 [7]. Diabetes mellitus is an

important risk factor for cardiovascular disease and atherosclerosis as it is a common secondary cause of hyperlipidemia when the glycemic control is poor [8]. The prevalence of dyslipidemia in type 2 diabetes is double with respect to the general population [9]. Approximately 80% of deaths in patients with diabetes are prone to coronary vascular diseases and the Asian Indians have high risk of coronary heart disease than whites [10].

In type 2 diabetics insulin resistance causes unrestricted lipolysis leading to increased fatty acid flux in liver and ends in higher hepatic triglyceride synthesis. Also, the activity of endothelial insulin dependent lipoprotein lipase is less resulting in decreased triglyceride clearance. Other processes involving apoprotein production and action of cholesteryl ester also get affected [11]. Objectives of our study was to evaluate lipid profile and to establish the relation between serums lipid profile and effect of duration of diabetes mellitus on lipid profile in type 2 diabetes mellitus patients.

Materials and Methods

The present study was conducted in the Department of Biochemistry with the collaboration of Department of Medicine, Sri Krishna Medical College, Muzaffarpur, Bihar, India during a period from June 2023 to November 2023.

Study Subjects: A total of 68 patients of type 2 diabetes mellitus were enrolled. The patients were in uniformity in socioeconomic status, culture and food habits. The patients were divided into two major groups, one group (Group I) was comprised 34 patients in old age group (DDO) with diabetes and dyslipidemia. And another group (Group II) was also comprised 34 old age non –diabetic but dyslipidemic patients (NDDO).

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 ≥ 35 years of age were excluded from the study. Subjects 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 the study.

Study Design: Randomly selected diabetic patients were subjected to evaluation for lipid profile, clinically and biochemically.

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 grams of glucose).

Fasting blood samples were used for estimation of all the parameters except for the postprandial serum glucose estimation [26]. All the biochemical estimations were done by using RFCL kit on the microlab -300 Semi Auto- analyzer.

Fasting and postprandial serum glucose were estimated quantitatively by GOD/POD technique as described by Trinder (1969) [12].

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) were 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) were calculated by subtracting serum HDL and VLDL from total serum cholesterol. All the observed data regarding patients were documented as prescribed Performa.

Statistical Analysis: Data was analyzed by using SPSS software. Two-tailed Student's t test was used compare the means of different parameters. P values was taken less than or equal to 0.05 ($p \leq 0.05$) for significant difference. Person's r value was used to estimate the correlation between two relevant variables.

Results

A total 68 subjects were included in this study. Out of 68 cases, 34 old age (50-60 years) patients of type 2 diabetes mellitus with dyslipidemia were enrolled in group I (DDO) and 34 old age (>60 years) patients of non-diabetic with dyslipidemia were enrolled in case group II (NDDO).

Table 1: Demographic details of group I and group II

| Groups | | Numbers (n) | Mean Age \pm SD | Sex ratio (M/F) |
|------------|------|-------------|-------------------|-----------------|
| Case group | DDO | 34 | 55.80 \pm 0.476 | 2.50 |
| | NDDO | 34 | 65.86 \pm 0.758 | 1.50 |

As shown in table 1, mean age of DDO case group was 55.80 \pm 0.476 years. Mean age of NDDO groups was 65.88 \pm 0.748 years. While, the sex ratio in these two groups were 2.50 and 1.5 respectively.

Table 2: Blood sugar levels and lipid profiles in old aged Diabetic and Dyslipidemic Patients (DDO) (n=34)

| | Mean (mg/dl) | SD | R value |
|------|--------------|---------|---------|
| FBS | 179.3654 | 30.2398 | -0.698 |
| PPBS | 246.0453 | 42.6754 | -0.687 |
| TC | 313.8762 | 35.7865 | 0.398 |
| HDL | 27.8341 | 1.9865 | -0.113 |
| LDL | 212.7654 | 34.8765 | 0.134 |
| VLDL | 76.7861 | 2.0341 | 0.591 |
| TG | 356.9832 | 35.6703 | 0.265 |

As shown in table 2, FBS and PPBS levels were 179.3654 \pm 30.2398 mg/dl and 246.0453 \pm 42.6754 mg/dl respectively in DDO group. Mean TC, HDL, LDL, VLDL and triglyceride level were 313.8762 \pm 35.7865 mg/dl, 27.8341 \pm 1.9865 mg/dl, 212.7654 \pm 34.8765 mg/dl, 76.7861 \pm 2.03

41 mg/dl and 356.9832 \pm 35.6703 mg/dl respectively. There is a positive correlation between age and TC, LDL, VLDL and triglyceride with r values 0.398, 0.134, 0.591 and 0.265 respectively. HDL was negatively correlated with age with r value -0.113

Table 3: Blood sugar levels and lipid profiles in DDO group with history of DM < 5 Yrs. (n=17)

| | Mean (mg/dl) | SD |
|------|--------------|---------|
| FBS | 165.3765 | 26.7439 |
| PPBS | 218.1869 | 27.7853 |
| TC | 304.2753 | 33.8591 |
| HDL | 27.7539 | 1.9989 |
| LDL | 209.6775 | 35.8692 |
| VLDL | 77.6754 | 3.6573 |
| TG | 335.1239 | 30.9837 |

Table 4: Blood sugar levels and lipid profiles in DDO group with history of DM > 5 Yrs. (n=17)

| | Mean (mg/dl) | SD |
|------|--------------|---------|
| FBS | 190.7685 | 28.9586 |
| PPBS | 276.1275 | 38.7432 |
| TC | 324.2165 | 35.6452 |
| HDL | 24.8865 | 1.0023 |
| LDL | 221.0123 | 37.7651 |
| VLDL | 78.8997 | 0.0009 |
| TG | 383.7888 | 27.8127 |

In table 3 and 4 when, we compared the lipid profiles of DDO group with history of diabetes < 5 years and > 5 years. We were found that the mean total cholesterol LDL, VLDL and TG were significantly higher in DDO with history of DM > 5 years.

Table 5: Blood sugar levels and lipid profiles in non-Diabetic Dyslipidemic (NDDO) Patients (n=34)

| | Mean (mg/dl) | SD | R values |
|------|--------------|---------|----------|
| FBS | 89.4553 | 11.2376 | 0.422 |
| PPBS | 128.8776 | 11.7862 | 0.499 |
| TC | 329.1176 | 39.6712 | 0.321 |
| HDL | 30.2113 | 1.9887 | -0.123 |
| LDL | 222.7635 | 37.8788 | 0.398 |
| VLDL | 69.8231 | 5.8564 | 0.302 |
| TG | 357.6543 | 26.7767 | 0.198 |

As shown in table 5, mean FBS and PPBS levels were 89.4553 \pm 11.2376 mg/dl and 128.8776

\pm 11.7862 mg/dl respectively in NDDO group. Mean TC, HDL, LDL, VLDL and triglyceride level

were 330.2222 ± 40.54987 mg/dl, 31.3333 ± 2.48 424 mg/dl, 224.5833 ± 39.52407 mg/dl, 70.9389 ± 6.2 183 mg/dl and 359.8333 ± 28.34935 mg/dl respectively. There is a positive correlation between

age and TC, LDL, VLDL and triglyceride with r values 0.321, 0.398, 0.302 and 0.198 respectively. HDL was negatively correlated with age with r value -0.123

Table 6: Comparison of DDO group patients with NDDO group patients.

| Variables | DDO (Mean \pm S.D.) | NDDO (Mean \pm S.D.) | P-value |
|-----------|------------------------|------------------------|---------|
| FBS | 179.3654 \pm 30.2398 | 89.4553 \pm 11.2376 | <0.0001 |
| PPBS | 246.0453 \pm 42.6754 | 128.8776 \pm 11.7862 | <0.0001 |
| TC | 313.8762 \pm 35.7865 | 329.1176 \pm 39.6712 | 0.101 |
| HDL | 27.8341 \pm 1.9865 | 30.2113 \pm 1.9887 | <0.0001 |
| LDL | 212.7654 \pm 34.8765 | 222.7635 \pm 37.8788 | 0.2616 |
| VLDL | 76.7861 \pm 2.0341 | 69.8231 \pm 5.8564 | <0.0001 |
| TG | 356.9832 \pm 35.6703 | 357.6543 \pm 26.7767 | 0.9304 |

As shown in table 6, FBS and PPBS were significant higher in DDO group as compared to NDDO group. Mean TC, HDL, LDL, VLDL and triglyceride level were 329.1176 ± 39.6712 mg/dl, 30.2113 ± 1.9887 , 222.7635 ± 37.8788 mg/dl, 69.8231 ± 5.8564 mg/dl and 357.6543 ± 26.7767 mg/dl respectively in NDDO group. While in DDO group mean TC, HDL, LDL, VLDL and triglyceride level were 313.8762 ± 35.7865 mg/dl, 27.8341 ± 1.9865 mg/dl, 212.7654 ± 34.8765 mg/dl, 76.7861 ± 2.0341 mg/dl and 356.9832 ± 35.6703 mg/dl respectively. In NDDO group TC, LDL, and Triglyceride levels were higher but not statistically significant.

Discussions

Diabetes mellitus is a group of metabolic disorders characterized by hyperglycemia resulting from defects in insulin secretion, insulin action or most commonly both.

In T2DM, lipid abnormalities are common. Typical findings are elevation of total and VLDL cholesterol, triglyceride concentration, exaggerated postprandial lipidemia, lowering of HDL cholesterol and a predominance of small, dense LDL-C particles [15]. Insulin resistance is often involved in this process [16]. Hypertriglyceridemia has been associated with increased risk of coronary heart disease both in non-diabetic and diabetic subjects [17,18]. Remnants of triglyceride rich lipoproteins seem to be extremely atherogenic [19]. Such dyslipidemia is related to life style factors such as diet and exercise [20]. It also has association with metabolic syndrome. [21] The Pro-atherogenic properties of small LDL particles may relate to their ability to penetrate the arterial wall and thereby making them more susceptible to oxidation, indirectly linked with coronary artery disease [22].

The present study was carried out on total of 68 cases of type 2 diabetes mellitus patients. Out of 68 cases, The patients were divided into two groups, group I was comprising 34 patients in old age group (50-60 years) (DDO) with diabetes and Dyslipidemia and another group II was

comprised of old age non-diabetic but dyslipidemic patients (NDDO).

Table 1 shows demographic details of all cases. Mean age of DDO and NDDO groups were 55.80 ± 0.476 years and 65.86 ± 0.758 years respectively. While sex ratio in in these two groups was 2.50 and 1.00 respectively.

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 [13].

Our findings were also supported by the study of Walter et al. [14] they were 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.

In the present study, when we compared the lipid profiles of DDO group with history of diabetes < 5 yrs and > 5 yrs. Mean total cholesterol LDL, VLDL and TG were significantly higher in DDO with history of DM > 5 yrs. HDL level was significantly reduced.

In NDDO group mean FBS and PPBS levels were well within normal range, they were 89.4553 ± 11.2376 mg/dl and 128.8776 ± 11.7862 mg /dl respectively. There was a positive correlation between age and TC, LDL, VLDL and triglyceride with r values 0.321, 0.398, 0.302 and 0.198 respectively. HDL was negatively correlated with age with r value -.123. When we compared DDO with NDDO group to find out the effects of DM over lipid profiles (table 6). FBS and PPBS were significant higher in DDO group as compared to NDDO group. Mean TC, HDL, LDL, VLDL and triglyceride level were 329.1176 ± 39.1176 mg/dl, 30.2113 ± 1.9887 mg/dl, 222.7635 ± 37.8788 mg/dl, 69.8231 ± 5.8564 mg/dl and 357.6543 ± 26.7767 mg/dl respectively in NDDO group. While in DDO group mean TC, HDL, LDL, VLDL

and triglyceride level were 313.8762 ± 35.7865 mg/dl, 27.8341 ± 1.9865 mg/dl, 212.7654 ± 34.8765 mg/dl, 76.7861 ± 2.0341 mg/dl and 356.9832 ± 35.6703 mg/dl respectively. In NDDO group TC, LDL, and Triglyceride levels were higher but not statistically significant while VLDL levels were significantly lower as compared to DDO. Age and diabetic state both are known to affect the lipid profiles.

Prevalence of dyslipidemia was shown to be increasing with ageing in our study and most common abnormality was high LDL, which is similar to study done by Pokharel, et al. [23] As age increases there will be reduced expression of hepatic LDL-C receptors leading to increased total cholesterol and LDL level due to impaired clearance from plasma [24]. Prevalence of dyslipidemia was shown to be more in patient with longer duration of diabetes and most common lipid abnormality was high LDL. This is supported by other study as well [25]. The exact mechanism by which altered lipid profile is more deranged with disease duration is not very well understood.

Conclusions

The present study concluded that the diabetes as well as increased age both are affected the lipid profile. TC, LDL, VLDL, and TG are increasing with advancing age and diabetes except HDL is no more increasing with advancing age. Hence, diabetes mellitus accelerates the age-related disturbance in lipid profile. So that, we should organized health check up camp in urban as well as rural area at time to time for awareness of dyslipidemia in old age diabetic patients.

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