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Original Article

Lipid patterns in Prediabetic and diabetic patients in Rural tertiary care centre

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ABSTRACT

OBJECTIVE: Dyslipidemia is an abnormal amount of lipids elevation in serum leads to hyperlipidemias (Hypercholesterolemia and Hypertriglyceredemia), which intern predisposes atherosclerosis and than triggers cardiovascular and cerebro vascular complications. The purpose of this case - control study was to correlate lipid patterns in Prediabetic and diabetic patients to non diabetic patients. **Method:** This study was done at the Department of Medicine, DR. PSIMS & RF foundation Chinaoutpally, A.P.India between Jan 2012 to Dec 2012. 450 patients (150 Prediabetic, 150 diabetic and 150 non diabetic patients of 75 males and 75 females in each group) above 18 years of age were included in the study. **Results:** High mean Cholesterol levels were 179.9 ± 34.28 , 207.29 ± 42.22 , 232.43 ± 55.88 in non diabetic, prediabetic and diabetic group respectively. High mean Triglyceride levels were 131.4 ± 63.03 , 171.3 ± 83.06 , 190.46 ± 80.71 in non diabetic, prediabetic and diabetic groups respectively. Low mean HDL - Cholesterol levels were 39.77 ± 10.34 , 37.21 ± 8.38 , 35.1 ± 7.54 in non diabetic, prediabetic and diabetic groups respectively. High mean LDL - Cholesterol levels were 112.88 ± 27.67 , 121.87 ± 43.91 , 131.96 ± 33.82 in non diabetic, prediabetic and diabetic groups respectively. **Conclusions:** Dyslipidemia is the commonest complication of prediabetes and diabetes mellitus and it predisposes to premature atherosclerosis causing cardiovascular and cerebro vascular complications.

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1. Introduction

Diabetes Mellitus is a Global epidemic and it has been a severe burden on health care systems. Diabetes Mellitus is a metabolic disorder of multiple etiologies that is characterized by increased blood glucose level resulting from defects in insulin secretion, insulin action or both. Type - I diabetes develops rapidly and occurs when there is a severe lack of insulin due to destruction of most of the β -cells in the islet of Langerhans where as type - 2 diabetes results due to a combination of genetic predisposition, increasing weight, unhealthy diet, physical inactivity and tends to have a more gradual onset^{1,2}. Prediabetes is a precursor to type 2 diabetes and is characterized by higher normal blood glucose levels. It is also called impaired glucose tolerance (IGT) or impaired fasting glucose (IFG) and glycated hemoglobin levels between 5.7 and 6.4 percent depending on the test used to diagnose it^{3,4}. IGT is a condition in which the blood sugar level is high (140 to 199 mg/dl) after a 2 hours oral glucose tolerance test but is not high enough to be

classified as diabetes and is associated with insulin resistance and increased risk of cardio vascular pathology⁵. IFG is a condition in which the blood sugar level is high (100 to 125 mg/dL - ADA criteria) formerly 110 mg/dl to 125 mg/dl - WHO criteria) but not high enough to be classified as diabetes. Prediabetes person are at high risk of developing type 2 diabetes, heart disease and stroke⁶. Lipid abnormalities are common in diabetes mellitus as insulin deficiency causes excessive metabolism of free fatty acids and insulin resistance reduces LPL (lipoprotein lipase) activity causing hypertriglyceredemia, elevated LDL cholesterol, elevated serum cholesterol and low HDL cholesterol^{7,8}. The rationale of this study was to detect the lipid abnormalities in prediabetic, diabetic and nondiabetic persons. Early detection and treatment of dyslipidemia can prevent the progression of lipid abnormalities and minimize the risk for atherogenic cardiovascular disorder and cerebro vascular accident.

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2. Materials and Methods

This prospective study was done in the department of General Medicine in Dr. PSIMS & RF, Chinaoutpally, Gannavaram, Krishna (Dist), Andhra Pradesh. 150 diagnosed diabetic, prediabetic and non diabetic cases in each group, who attended to our hospital and equal sex distribution (75:75) were included. All patients survive till the end of study period of one year duration i.e. Jan-2012 to Dec – 2012.

Diagnosis of diabetes, prediabetes and non diabetic cases were done as per the biochemical parameters FBS, HbA1c (Based on ADA criteria). Diabetes cases were diagnosed when Fasting blood sugar (glucose) level of >125 mg/dL and Glycated hemoglobin between >6.4 percent.

Prediabetes cases were diagnosed when Fasting blood sugar (glucose) level of 125 mg/dl. (5.6 mM to 6.9 mM) and Glycated hemoglobin between 5.7 and 6.4 per. Non diabetes cases were diagnosed when Fasting blood sugar (glucose) level of <100 mg/dl and Glycated hemoglobin <5.7 percent.

Lipid profile (Cholesterol, triglyceride. HDL- Cholesterol and LDL - cholesterol were estimated in both cases and controls. The study was approved by the Ethics committee of our college. After fulfilling the inclusion and exclusion criteria, prior consent was obtained from the subjects.

Inclusion criteria;

Patients with diabetic, prediabetic or non diabetic patients with Age 18 or older

Exclusion criteria:

Patients with heart failure, acute febrile illness, renal, hepatic, malignant disorders,

chronic illnesses, asymptomatic infections and smokers

Sample collection and analysis:

Both heparinised and plain blood samples were collected from each case and control. For analysis of FBS, lipid profile - serum was used and for HbA1c - whole blood was used. Serum glucose estimation was done by Trindlers GOD - POD method (commercial kit ERBA - MANNHEIM), cholesterol estimation was done by CHOD - POD method⁹. (commercial kit - ERBA - MANNHEIM), Triglycerides estimation was done by GPO10 method (commercial kit - ERBA - MANNHEIM), HDL cholesterol estimation was done by APO protein precipitation or PTA11 method (ERBA - MANNHEIM), and HbA1c estimation was done by Ion exchange resin method (commercial kit - Randox Rx series). All these estimations were performed by Randox Daytona Autoanalyzer. VLDL-c or LDL-c levels of all cases and controls were calculated by using Friedwald's formula¹².

3. Results

The mean age was 50.61 ± 9.75 , 48.35 ± 9.2 , 52.89 ± 8.27 in non diabetic, prediabetic and diabetic groups respectively. Among males mean ages were 52.8 ± 7.74 , 49.92 ± 8.03 , 54.56 ± 7.71 in non diabetic, prediabetic and diabetic groups respectively. Among females mean ages were 48.41 ± 10.05 , 46.81 ± 7.91 , 51.23 ± 8.53 in non diabetic, prediabetic and diabetic groups respectively which showed mean age of prediabetics was less than non diabetic and diabetic groups in males and females (p -value <0.05). The mean BMI was 27.8 ± 5.1 , 29.79 ± 5.08 , 31.26 ± 5.28 in non diabetic, prediabetic and diabetic groups respectively. Among males mean BMI were 26.72 ± 4.53 , 27.7 ± 4.42 , 30.3 ± 5.54 in non diabetic, prediabetic and diabetic groups respectively. Among females mean BMI was 28.9 ± 5.45 , 31.8 ± 4.4 , 32.1 ± 4.88 in non diabetic, prediabetic and diabetic groups respectively, which showed mean BMI of females was more than males in all three groups (p - value <0.05).

The mean FBS was 90.71 ± 7.09 , 111.63 ± 8.31 , 150.44 ± 36.97 in non diabetic, prediabetic and diabetic groups respectively. Among males mean FBS were 92.48 ± 5.39 , 113.1 ± 7.99 , 157.4 ± 45.7 in non diabetic, prediabetic and diabetic groups respectively. Among females mean FBS were 88.95 ± 8.12 , 110.2 ± 8.46 , 143.4 ± 23.5 in non diabetic, prediabetic and diabetic groups respectively, which showed mean FBS of males was more than females in all three groups (p - value <0.05). The mean HbA1c was 5.183 ± 0.307 , 5.989 ± 0.222 , 8.51 ± 0.804 in non diabetic, prediabetic and diabetic groups respectively. Among males mean HbA1c were 5.249 ± 0.332 , 6.039 ± 0.245 , 8.781 ± 0.799 in non diabetic, prediabetic and diabetic groups respectively. Among females mean HbA1c was 5.117 ± 0.265 , 5.94 ± 0.185 , 8.239 ± 0.717 in non diabetic, prediabetic and diabetic groups respectively which showed mean HbA1c of males were more than females in all three groups (p - value <0.05).

The mean Cholesterol levels was 179.9 ± 34.28 , 207.29 ± 42.22 , 232.43 ± 55.88 in non diabetic, prediabetic and diabetic groups respectively. Among males mean Cholesterol levels were 187.09 ± 29.48 , 214.27 ± 39.9 , 248.2 ± 56.73 in non diabetic, prediabetic and diabetic groups respectively. Among females mean Cholesterol levels were 172.71 , 37.3 , 200.31 ± 43.56 , 216.65 ± 50.64 in non diabetic, prediabetic and diabetic group respectively, which showed mean Cholesterol levels of males was more than females in three groups (p - value <0.0097 , 0.0425 & 0.0004).

The mean Triglyceride levels were 131.4 , $+63.03$, 171.3 ± 83.06 , 190.46 ± 80.71 in non diabetic, prediabetic and diabetic groups respectively. Among in males mean Triglyceride levels were 144.83 , $+74.83$, 185.72 ± 84.15 , 206.16 , 105.1 in non diabetic, prediabetic and diabetic groups respectively. Among females mean Triglyceride levels were 115.11 , $+45.13$, 156.88 ± 76.63 , 174.76 ± 39.63 in non diabetic, prediabetic and diabetic groups respectively. Which showed mean Triglyceride levels of males was more than females in three groups (p - value <0.009 , 0.0298 & 0.0167).

2. Methods

The mean HDL - Cholesterol levels were 39.77 ± 10.34 , 37.21 ± 8.38 , 35.1 ± 7.54 in non diabetic, prediabetic and diabetic groups respectively. Among males mean HDL -Cholesterol levels were 38.92 ± 12.61 , 36.19 ± 7.53 , 31.93 ± 6.22 in non diabetic, prediabetic and diabetic groups respectively. Among females mean HDL - Cholesterol levels were 40.61 ± 7.41 , 38.24 ± 9.09 , 38.27 ± 7.45 in non diabetic, prediabetic and diabetic groups respectively, which showed mean HDL - Cholesterol levels of males was less than females in three groups (p - value <0.31 , 0.13 & 0.0001), but statistically significant lower levels was found in diabetic male patients.

The mean LDL - Cholesterol levels were 112.88 ± 27.67 , 121.87 ± 43.91 , 131.96 ± 33.82 in non diabetic, prediabetic and diabetic groups respectively. Among males mean LDL - Cholesterol levels were 117.87 ± 22.75 , 133.08 ± 43.16 , 140.08 ± 28.44 in non diabetic, prediabetic and diabetic groups respectively. Among females mean LDL - Cholesterol levels were 107.49 ± 31.14 , 110.65 ± 42.0 , 123.84 ± 36.9 in non diabetic, prediabetic and diabetic groups respectively which showed mean LDL -Cholesterol levels of males was more than females in three groups (p - value <0.0212 , 0.0016 & 0.003).

Table 1. General parameters in non diabetic, prediabetic and diabetic groups

| | NON DIABETES | PREDIABETES | DIABETES |
|------------|-------------------|-------------------|--------------------|
| N | 150 | 150 | 150 |
| Male | 75 | 75 | 75 |
| female | 75 | 75 | 75 |
| Mean age | 50.61 ± 9.75 | 48.35 ± 9.2 | 52.89 ± 8.27 |
| Males | 52.8 ± 7.74 | 49.92 ± 8.03 | 54.56 ± 7.71 |
| females | 48.41 ± 10.05 | 46.81 ± 7.91 | 51.23 ± 8.53 |
| Mean BMI | 27.8 ± 5.117 | 29.79 ± 5.084 | 31.26 ± 8.53 |
| Males | 26.72 ± 4.53 | 27.7 ± 4.42 | 30.3 ± 5.54 |
| females | 28.9 ± 5.45 | 31.8 ± 4.86 | 32.1 ± 4.88 |
| Mean FBS | 90.71 ± 7.09 | 111.63 ± 8.31 | 150.44 ± 36.97 |
| Males | 92.48 ± 5.39 | 113.1 ± 7.99 | 157.4 ± 45.7 |
| females | 88.95 ± 8.12 | 110.2 ± 8.46 | 143.4 ± 23.5 |
| Mean HbA1c | 5.183 ± 0.307 | 5.989 ± 0.222 | 8.51 ± 0.804 |
| Males | 5.249 ± 0.332 | 6.039 ± 0.245 | 8.781 ± 0.799 |
| females | 5.117 ± 0.265 | 5.94 ± 0.185 | 8.239 ± 0.717 |

Table 2. Mean Cholesterol levels in males and females of 3 groups

| | Males | Females | P value |
|--------------|--------------------|--------------------|---------|
| Non Diabetes | 187.09 ± 29.48 | 172.71 ± 37.3 | 0.0097 |
| Prediabetes | 214.27 ± 39.9 | 200.31 ± 43.56 | 0.0425 |
| Diabetes | 248.2 ± 56.73 | 216.65 ± 50.64 | 0.0004 |

Table 3. Mean Triglyceride levels in males and females of 3 groups

| | Males | Females | P value |
|--------------|--------------------|--------------------|---------|
| Non Diabetes | 144.83 ± 74.83 | 118.11 ± 45.13 | 0.009 |
| Prediabetes | 185.72 ± 84.15 | 156.88 ± 76.63 | 0.0298 |
| Diabetes | 206.16 ± 105.1 | 174.76 ± 39.63 | 0.0167 |

Table 4. Mean HDL levels in males and females of 3 groups

| | Males | Females | P value |
|--------------|-------------------|------------------|---------|
| Non Diabetes | 38.92 ± 12.61 | 40.61 ± 7.41 | 0.31 |
| Prediabetes | 36.19 ± 7.53 | 38.24 ± 9.09 | 0.13 |
| Diabetes | 31.93 ± 6.22 | 38.27 ± 7.45 | 0.0001 |

Table 5. Mean LDL levels in males and females of 3 groups

| | Males | Females | P value |
|--------------|--------------------|--------------------|---------|
| Non Diabetes | 117.87 ± 22.75 | 107.49 ± 31.14 | 0.0212 |
| Prediabetes | 133.08 ± 43.16 | 110.65 ± 42.0 | 0.0016 |
| Diabetes | 140.08 ± 28.44 | 123.84 ± 36.9 | 0.0030 |

Table 6. Comparison of elevated lipid fractions between non diabetes, prediabetes and diabetic groups

| Variable | Non diabetes n 150 | Prediabetes n 150 | Diabetes n 150 |
|--------------|---------------------------|-----------------------------|-----------------------------|
| Cholesterol | 14 (9.6%) M:8 F:6 | 50 (33.3%) M:24 F:2 | 87 (58%) M:51 F:3 |
| Triglyceride | 22 (14.6%) M:13 F:9 | 668 (45.3%) M:39 F:2 | 680 (53.3%) M:46 F:34 |
| HDL | 13 (8.6%) M:8 F:5 | 973 (48.6%) M:43 F:3 | 105 (70%) M:61 F:44 |
| LDL | 15 (10%) M:9 F:6 | 055 (36.6%) M:37 F:19 | 73 (48.6%) M:44 F:29 |

Table 7. Combined elevated lipid fractions between non diabetes, prediabetes and diabetic groups

| Variable | Non diabetes | Prediabetes | Diabetes |
|----------------|--------------|-------------|------------|
| Total (n 150) | 7 (4.6%) | 28 (18.6%) | 49 (32.6%) |
| Males (n 75) | 4 (5.3%) | 17 (22.6%) | 27 (36%) |
| Females (n 75) | 3 (4%) | 11 (14.6%) | 22 (29.3%) |

4. Discussion

Lipid abnormalities are common in diabetes and prediabetics. Many factors may affect blood lipid levels because carbohydrates and lipid metabolism are interrelated to each other and if there is any disorder in carbohydrate metabolism it also leads to lipid

metabolism disorder resulting in high cholesterol, triglyceride, LDL cholesterol and low HDL cholesterol levels 12,13. In this study we have elevated the pattern of lipid profile parameters in prediabetic, diabetic and non diabetic subjects. 33.3% of pre diabetic should raised cholesterol (>200mg/dl) and 45.3% raised triglycerides levels (>150mg/dl) compared to the non diabetic subject which should 9.6%, 14.6%, 10% respectively. Among diabetic subjects mean cholesterol, mean triglycerides, and mean LDL-C was raised in 58%, 53.3% and 48.6% respectively. Our study also showed the mean HDL-C is low in 48.6% in prediabetic subjects and 70% in diabetic subjects. . Our study showed the mean cholesterol levels, mean triglyceride levels LDL cholesterol levels were more in males in prediabetic, diabetic and non diabetic groups than in females. In our study males had higher levels of LDL-C as compared to females and this finding was consistent with that by Ahmad et.al¹⁵. Male diabetic patients has a significant effect on risk of coronary artery disease as male have originally high serum lipid levels compared to diabetic females.

5. Conclusions

Dyslipidemia is the commonest complication of prediabetes and diabetes mellitus and it predisposes to premature atherosclerosis causing cardiovascular and cerebro vascular complications. Early detection and intervention of lipid abnormalities among prediabetic & diabetic patients will decrease the progression of atherosclerosis and prevent the cerebrovascular & cardiovascular complications.

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