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# Evaluation of Malondialdehyde a, Oxidative Stress marker & Dyslipidemia in Type 2 Diabetes Mellitus patients: A Case control study.

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**Abstract**

**Introduction:** Diabetes is characterized by chronic hyperglycemia & disturbances of carbohydrate, lipid and protein metabolism. In subtypes of Diabetes Mellitus, type II diabetes mellitus is the most common endocrine and metabolic disorder. DM is a condition of increased oxidative stress and requires antioxidant.

**Aim:** To assess the association between of oxidative stress and lipid abnormalities in type 2 diabetes mellitus patients in comparison with healthy subjects.

**Materials & Method:** This is a case control study, conducted in Department of Biochemistry, Era's Lucknow Medical University, Lucknow, U.P., India between January 2022 to June 2022. A total of 90 cases of type II diabetes mellitus & 90 cases of healthy subjects between the age of 30 and 60 years were enrolled in study. Fasting blood glucose, glycated hemoglobin (HbA1c), total cholesterol (TC), triglycerides (TG), high density lipid (HDL) and malondialdehyde (MDA) levels were assessed.

**Results:** The mean age of type II diabetes mellitus cases were higher 55.2±10.1yr and 45±14 yrs in healthy subjects. The body mass index was higher 29.7±3.8 kg/$m^2$ and 24.8±5.3 in healthy controls. Significant difference was observed in FBS, Hb1Ac, TC, TG, LDL, HDL along with VLDL & MDA. With TC, LDL, VLDL, FBS, HbA1c shows positive correlation between MDA and HDL.

**Conclusion:** Increased blood glucose levels along with dyslipidemia in patients with diabetes causes oxidative stress leading to atherosclerosis. Early detection and treatment of lipid abnormalities may be used to minimize risk for atherogenic cardiovascular disorder & cerebrovascular accident in patients with diabetes.

**Keywords:** Metabolic disorder, Hb1Ac, Dyslipidemia, Malondialdehyde.

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**Introduction:** Diabetes Mellitus one of the major health disorders of 21st century. About 422 million people worldwide are suffering from diabetes. 352 million are estimated to have impaired glucose tolerance test respectively [1]. 1.5 million deaths are directly attributed to diabetes every year. Prevalence of diabetes in past few years have been increasing steadily.[2]

Diabetes Mellitus is characterized by chronic hyperglycemia & imbalance in carbohydrate, lipid and protein metabolism. Hyperglycemia is a key diagnostic feature of diabetes. In majority of cases, it is seen that diabetes is coupled with an increase in levels of total cholesterol, triglycerides, low density lipoprotein and decrease in high density lipoprotein levels in blood. Dyslipidemia is a primary cause of atherosclerosis [3].

Glycated hemoglobin (HbA1c) is predictor for long term sugar control and also forecast the risk for occurrence of diabetes complication [4].

Several studies have demonstrated that increase in malondialdehyde (MDA), product of peroxidation of poly unsaturated fatty acid leads to induction of acute hyperlipidemia which increases the level of oxidative stress[5].

Oxidative stress, equilibrium between generation and removal of reactive oxygen species (ROS). In healthy condition, antioxidant enzymes regulate the levels of reactive oxygen species production. Malondialdehyde is commonly used to evaluate the level of oxidative stress[5].

Hyperactivity of hexosamine pathway, transfer of glucose in polyol pathway is increased generates advanced glycation product within the cell [6].

This study was undertaken to evaluate the relationship between Lipid Profile and oxidative stress in type II diabetes mellitus in comparison with healthy subject.

**Materials & Method:** This is an observational, case control study conducted in Department of Biochemistry, Era's Lucknow Medical University, Lucknow, U.P., India during January 2022 to June 2022. 90 cases of Type II DM & 90 healthy subjects from OPD were enrolled in study after obtaining the written informed consent.

**Inclusion criteria**: Patients with type II diabetes Mellitus.

**Exclusion criteria:** Patients with malignancy, neuropathy, chronic liver disease, hypothyroidism were excluded.

**Sample collection & biochemical analysis:** 10ml venous blood was drawn by phlebotomist. Sample was allowed to stand for 30 min and centrifuged at 3000rpm for 15 min following parameters were estimated.

1. Fasting blood sugar: glucose oxidase-peroxidase method.
2. HbA1c: cation exchange method.
3. Cholesterol by cholesterol oxidase enzymatic end point method.
4. Triglyceride by enzyme mediated glycerol phosphate oxidase/peroxidase method.
5. HDL-C: by direct enzymatic end point process.
6. Freidwald formula's LDL-C: TC-(HDL+VLDL) [12].
7. Freidwald equation VLDL: TG/5.
8. Malondialdehyde (MDA) by thiobarbituric acid residue substances (TBARS) method.

## Statistical Analysis:

Statistical analysis was performed using SPSS software (version 16.0) for windows (SPSS, INC, Chicago, IL). Serum concentrations were expressed as mean ± standard deviation. Student't test was used to compare the difference between various clinical variants. Correlation was determined by Pearson's correlation. For all test 'p' value less than 0.05 was considered significant.

**Results:**

Present study was carried out on 90 cases & 90 controls. Here, mean age of cases & controls was 55.2±10.1& 45±14 years respectively and the difference between them was statistically significant (p<**0.03**). Similarly, BMI in type II Diabetes mellitus cases was higher 29.7±3.8 & controls was 24.8±5.3 kg/$m^2$ significantly higher than controls (p<**0.01**) (Table 1).

In type II DM, fasting blood sugar, glycated hemoglobin HbA1c levels were significantly higher than controls (p<**0.03**) table 2. In type II diabetes, serum lipids along with lipoprotein were substantially higher when compared to control where as in HDL-C levels were lower in cases as compared to controls (p<**0.008**) table 2. Mean Cholesterol levels was slightly higher in diabetes

as compared to normal control (p<**0.05**) table 2. Similarly, significant difference was seen among TG, LDL, VLDL levels than controls (p<0.05) Table 2.

Malondialdehyde (MDA), was associated with FBS (r=**0.002**), HbA1c (r=**0.06**), TC (r=**0.007**), TG(r=**0.005**), HDL(r=**0.006**), LDL(r=**0.034**), VLDL (r=**0.002**) as seen in table 3.

**Table 1: Comparison of Age, Sex & Anthropometric parameter in Type II Diabetes Mellitus patients & healthy subjects.**

| Variable | Type II Diabetes mellitus | Healthy subjects | 'p' value |
|---|---|---|---|
| **Age mean(yrs)** | 55.2±10.1 | 45±14 | **0.03** |
| **BMI (kg/m$^2$)** | 29.7±3.8 | 24.8±5.3 | **0.01** |

**Table 2: Comparison of biochemical parameters fasting blood sugar, Glycated hemoglobin (HbA1c), Lipid Profile & malondialdehyde (MDA) in Type II Diabetes Mellitus patients & healthy subjects.**

| Biochemical parameters | Type II Diabetes mellitus | Healthy subjects | 'p' value |
|---|---|---|---|
| **1) FBS(mg/ml)** | 160±45.3 | 99±11.9 | **0.03** |
| **2) HbA1c(%)** | 7.9±1.3 | 4.9±0.2 | **0.007** |
| **Lipid profile** | | | |
| 1) TC**(mg/ml)** | 264±46 | 161.7±20.9 | **0.05** |
| 2) TG**(mg/ml)** | 124±78.4 | 107±20.9 | **0.05** |
| 3) HDL**(mg/ml)** | 40.9±11.5 | 52.7±6.1 | **0.008** |
| 4) LDL**(mg/ml)** | 104.5±40.4 | 86.6±20.7 | **0.05** |
| 5) VLDL**(mg/ml)** | 46±8.52 | 33.62±3.35 | **0.05** |
| **MDA(nmol/ml)** | 6.7±2.5 | 2.4±1.1 | **0.02** |

**Table 3: Correlation of Fasting blood sugar, HbA1c & Lipid profile with MDA in type II diabetes mellitus cases.**

| Biochemical parameters | Pearson correlation coefficient (r) |
|---|---|
| **1) FBS(mg/ml)** | **+0.002** |
| **2) HbA1c(%)** | **+0.06** |
| **Lipid profile** | |
| **3)** TC**(mg/ml)** | **+0.007** |
| **4)** TG**(mg/ml)** | **+0.005** |

| | |
|---|---|
| **5)** HDL**(mg/ml)** | **-0.006** |
| **6)** LDL**(mg/ml)** | **+0.034** |
| **7)** VLDL**(mg/ml)** | **+0.002** |

**Discussion:**

In last few decades diabetes has emerged as a major health risk worldwide associated with several cardiovascular disorder. Diabetes, a common metabolic endocrine disorder, it is characterized by elevated glucose level in blood associated with multiple biological & epigenetic factor [3].

In present study the mean age of Type II DM was 55.2±10.1 & 45±14 years in healthy controls. Mean BMI was observed to be higher in cases 29.7±3.8 than 24.8±5.3 in healthy controls. Difference between mean age and BMI in cases and control were statistically significant and in accordance with findings by Yadav et al. [7].

In type II DM cases it was observed that levels of FBS & HbA1c are significantly increased as compared to healthy cases according to Sherwani et al., The glycated hemoglobin reflects the integrated glucose levels over the intervening 6-8 weeks [8].

In previous studies, correlation is seen among dyslipidemia & Diabetes mellitus. In present study we observed elevated levels of TC, TG, LDL, VLDL while HDL levels was found to be lower as compared to controls. In lipid profile we found statistical difference between cases and control except TC in which the levels were elevated but the difference was not significant. Findings are according to study by Yadav et al [7].

Malondialdehyde, lipid peroxidation product is used to measure the level of oxidative stress by thio barbituric acid reactive substances (TBARS) method. In this study there was a significant difference between the levels of MDA in cases and controls. Several studies have shown link between diabetes and oxidative stress by measuring MDA [9]

**Conclusion:**

In present study Fasting blood sugar, Glycated hemoglobin, TC, TG, LDL, VLDL and MDA were elevated in cases. Significant correlation was found between HbA1c, HDL, MDA.

Several experiments have shown link between diabetes and oxidative stress by measuring various markers e.g, Malondialdehyde. It is believed that onset and progression of late diabetic complication, leads to generation of free radical which have ability to damage lipid , protein & DNA [10].

Various clinical condition are induced by oxidative stress like DM, cancer rheumatoid arthritis [11].

Hyperglycemia leads to oxidative stress progress to epithelial dysfunction in blood vessel of diabetic patients. Increase in the level of insulin along with dyslipidemia in patients suffering from diabetes develop microangiopathies and further atherosclerosis.

Hence, we conclude that early detection and treatment of lipid abnormalities can minimize the risk for atherogenic cardiovascular and other related disorders in patients with DM [13].

Evaluation of dyslipidemia & oxidative stress can be used as a prevention tool for complication of DM. To verify this proposal large sample size is required.

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