Section: General Medicine

Original Research Article

UNDERSTANDING THE RELATIONSHIP BETWEEN PREVALENCE OF DYSLIPIDEMIA, HYPERTENSION, AND DIABETES MELLITUS

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ABSTRACT

Background: BMI (body mass index) is a conventional measurement that divides an individual's weight by height to assess whether they are in a healthy weight range. It is vital to understand the relationship between diabetes mellitus hypertension and dyslipidemia. **Aim:** The present study aimed to understand the relation between the prevalence of dyslipidemia, hypertension, and diabetes mellitus in the Indian context.

Materials and Methods: The present study assessed BMI distribution in subjects with diabetes mellitus who visited the Institute within the defined study period, and BMI distribution was compared in subjects with and without dyslipidemia and hypertension. Improper insulin secretion results in the alteration of carbohydrate, protein, and lipid metabolism and characterizes hyperglycemia, which is usually considered DM (diabetes mellitus).

Results: The study results showed that there is a significant increase in the Body Mass Index of subjects with diabetes mellitus compared to subjects from the control group. A statistically significant positive correlation is seen between MDA, cholesterol, and glycated hemoglobin levels in study subjects.

Conclusion: The present study concludes that for the management and prevention of vascular complications in subjects with type 2 diabetes mellitus, it is vital to maintain normal levels of MDA (malondialdehyde) and normal body weight. However, further large-scale and long-term studies are needed to confirm the conclusion of the present study.

Keywords: BMI, body mass index, diabetes mellitus, lipid peroxidation, malondialdehyde, oxidative stress.

INTRODUCTION

DM (diabetes mellitus) represents a metabolic disorder that has a high prevalence and is exponentially increasing at an alarming rate globally including in India. The subjects with diabetes mellitus have depicted an alteration in their condition in the last three decades which was earlier depicted as a mild disorder of the elderly and is presently seen in middle-aged and young subjects and is a major cause of morbidity and mortality in affected subjects.[1]

Type 1 diabetes mellitus has a characteristic presentation of deranged function and secretion of endogenous insulin which depicts the clinical presentation of hyperglycemia. Type II Diabetes mellitus is perceived as a global concern which initially shows a very slow development with insulin resistance and progress with time leading to failure of the body in maintaining the hemostasis of glucose.[2]

The immune system in a human works in an organized fashion to sustain the normal equilibrium and helps in attaining a disease-free state. In a few conditions, there is an increase in the formation of free radicals which lead to lipid peroxidation and oxidative stress as seen in diabetes mellitus DM-associated complications as micro- and macro-

vascular complications, neuropathy, nephropathy, and diabetic ketoacidosis are seen when ROS (reactive oxygen species) formation is increased.[3]
Lipid peroxidation results in the pathogenesis of various degenerative diseases including carcinogenesis, diabetes, and atherosclerosis. Lipid peroxidation starts fatty acyl side chain or fatty acid of any chemical species which results in to H-atom from a methylene carbon in the side chain, in which removal of the hydrogen atom is much easier which is polyunsaturated fatty acids that are more susceptible to peroxidation.[4] The present study aimed to assess oxidative stress by measuring MDA (malondialdehyde) and BMI along with other variables in subjects with type II diabetes mellitus with and without complications. The study also aimed at correlating levels of MDA and BMI in study subjects to see if BMI and serum MDA levels can be assessed from values in both groups.

MATERIALS AND METHODS

The present clinical assessment study aimed to assess oxidative stress by measuring MDA (malondialdehyde) and BMI along with other variables in subjects with type II diabetes mellitus with and without complications. The study also aimed at correlating levels of MDA and BMI in study subjects to see if BMI and serum MDA levels can be assessed from values in both groups. The study subjects were from the Outpatient Department of the Institute. Verbal and written informed consent were taken from all the subjects before participation. The study assessed subjects aged 40-55 years from both genders who visited the Institute within the defined study period and comprised 140 subjects with type II diabetes mellitus who were on oral hypoglycemic drugs. Disordered diabetic subjects were divided into two groups based on the presence or absence of other diseases including vascular complications, thyroid disorders, and hypertension where Group I included subjects without other disease history and Group II included subjects with vascular complications and other diseases. The study assessed 70 gender and age-matched controls that were healthy and without diabetes mellitus.
In all the included subjects, biochemical assessment was done including random fasting blood samples which were collected immediately after enrolment. The centrifugation of the sample was done for 10 minutes at 2000 rpm. Further, other related lipid profile factors including triglycerides total cholesterol, and fasting blood glucose were assessed using the auto analyzer. Utilizing the thiobarbituric acid reactive substances method and an ion exchange resin method, both serum MDA and HbA1c (glycated hemoglobin) levels were assessed in all the subjects.[5]
The data gathered were analyzed statistically using SPSS (Statistical Package for the Social Sciences) software version 24.0 (IBM Corp., Armonk. NY, USA) for assessment of descriptive measures, Student t-test, ANOVA (analysis of variance), Turkey post hoc analysis, and Chi-square test. Pearson correlation coefficient was used to assess correlation in various parameters. The results were expressed as mean and standard deviation and frequency and percentages. The p-value of <0.05 was considered.

RESULTS

The present clinical assessment study aimed to assess oxidative stress by measuring MDA (malondialdehyde) and BMI along with other variables in subjects with type II diabetes mellitus with and without complications. The study also aimed at correlating levels of MDA and BMI in study subjects to see if BMI and serum MDA levels can be assessed from values in both groups. The study assessed 140 subjects with type II diabetes mellitus who were on oral hypoglycemic drugs. Disordered diabetic subjects were divided into two groups based on the presence or absence of other diseases including vascular complications, thyroid disorders, and hypertension where Group I included subjects without other disease history and Group II included subjects with vascular complications and other diseases. The study assessed 70 gender and age-matched controls that were healthy and without diabetes mellitus.
It was seen that the mean age of controls was 45.5±3.6 years, 46.0±4.3 years in Group I type II DM subjects without complications, and 46.2±3.9 years in Group I type II DM subjects with complications. There were 80% (n=56) males and 20% (n=14) females in controls, 81.42% (n=57) males and 18.57% (n=13) females in Group I type II DM subjects without complications, and 82.8% (n=58) males and 17.14% (n=12) females in Group I type II DM subjects with complications. Mean BMI was 24.6±1.601, 27.11±1.584, and 28.51±2.926 kg/m2 in controls, Group I, and Group II study subjects respectively. The waist and hip ratio was 0.893±0.035, 0.90±0.027, and 0.923±0.023 in in controls, Group I, and Group II study subjects respectively. [Table 1]
The study results showed that for comparison of biochemical variables in various groups of study subjects, MDA levels were significantly higher in Group II type II DM with complications with 115.3±12.79 nmol/dl followed by 93.1±10.07 nmol/dl in Group I, and 59.46±3.774 nmol/dl in controls. Similar significantly higher values of TG (triglycerides) were seen in Group II type II DM with complications compared to 171.4±17.03 in Group I, and least in controls with $p<0.05$. Cholesterol levels were significantly higher in Group II compared to Group I and least in controls with $p<0.001$. Similar results were seen for HbA1c, PPBG, and FBG where values were significantly higher in Group II type II DM with complications

followed by Group, I type II DM without complications and controls p<0.01. [Table 2]
On assessing the correlation of BMI and other study parameters in study participants, a significant association of BMI was seen with MDA, TG, cholesterol, HbA1c, PPBG, and FBG with r-value (correlation coefficient) value of 0.387, 0.254, 0.365, 0.501, 0.254, and 0.182 respectively. [Table 3]

Table 1: Comparison of baseline data in controls and type 2 DM groups of study subjects

S. No	Parameter	Controls (n=70)	Group I type II DM without complications (n=70)	Group II type II DM with complications (n=70)
1.	**Mean age (years)**	45.5±3.6	46.0±4.3	46.2±3.9
2.	**Gender**			
3.	Males	56 (80)	57 (81.42)	58 (82.8)
4.	Females	14 (20)	13 (18.57)	12 (17.14)
5.	**Mean BMI (kg/m2)**	24.6±1.601	27.11±1.584	28.51±2.926
6.	**Waist and hip ratio**	0.893±0.035	0.90±0.027	0.923±0.023

Table 2: Comparison of biochemical variables in various groups of study subjects

S. No	Biochemical Parameter	Controls (n=70)	Group I type II DM without complications (n=70)	Group II type II DM with complications (n=70)
1.	**MDA (nmol/dl)**	59.46±3.774	93.1±10.07	115.3±12.79
2.	**TG (mg/dl)**	99.76±11.87	171.4±17.03	183.4±20.9
3.	**Cholesterol (mg/dl)**	112.1±8.292	191.0±22.31	210.1±18.12
4.	**HbA1c**	5.7±0.1	7.3±0.49	8.611±0.6
5.	**PPBG (mg/dl)**	107.30±8.183	163.3±21.04	193.7±18.42
6.	**FBG (mg/dl)**	91.72±8.37	131.5±22.94	143.40±42.45

Table 3: Correlation of BMI and other study parameters in study participants

S. No	Parameters	r (correlation coefficient)
1.	**MDA**	**0.387**
2.	**TG**	**0.254**
3.	**Cholesterol**	**0.365**
4.	**HbA1c**	**0.501**
5.	**PPBG**	**0.254**
6.	**FBG**	**0.182**

DISCUSSION

The present study assessed 140 subjects with type II diabetes mellitus who were on oral hypoglycemic drugs. Disordered diabetic subjects were divided into two groups based on the presence or absence of other diseases including vascular complications, thyroid disorders, and hypertension where Group I included subjects without other disease history and Group II included subjects with vascular complications and other diseases. The study assessed 70 gender and age-matched controls that were healthy and without diabetes mellitus. The design of the present study was similar to the study design adopted by Ganjifrockwala FA et al,[6] in 2017 and Ahmad S et al,[7] in 2017 where a study design similar to the present study was also adopted by the authors in their respective studies.
The study results showed that the mean age of controls was 45.5±3.6 years, 46.0±4.3 years in Group I type II DM subjects without complications, and 46.2±3.9 years in Group I type II DM subjects with complications. There were 80% (n=56) males and 20% (n=14) females in controls, 81.42% (n=57) males and 18.57% (n=13) females in Group I type II DM subjects without complications, and 82.8% (n=58) males and 17.14% (n=12) females in Group I type II DM subjects with complications. Mean BMI was 24.6±1.601, 27.11±1.584, and 28.51±2.926 kg/m2 in controls, Group I, and Group II study subjects respectively. The waist and hip ratio was 0.893±0.035, 0.90±0.027, and 0.923±0.023 in controls, Group I, and Group II study subjects respectively. These data were comparable to the studies by Luna P et al,[8] in 2016 and Dal Canto E et al,[9] in 2019 where authors assessed subjects with demographic data and demographics comparable to the present study in their respective studies.
It was seen that for comparison of biochemical variables in various groups of study subjects, MDA levels were significantly higher in Group II type II DM with complications with 115.3±12.79 nmol/dl followed by 93.1±10.07 nmol/dl in Group I, and 59.46±3.774 nmol/dl in controls. Similar significantly higher values of TG (triglycerides) were seen in Group II type II DM with complications compared to 171.4±17.03 in Group I, and least in controls with p<0.05. Cholesterol levels were significantly higher in Group II compared to Group I and least in controls with p<0.001. Similar results were seen for HbA1c, PPBG, and FBG where values were significantly higher in Group II type II DM with complications followed by Group, I type II DM without complications and controls p<0.01. These results were consistent with the findings of Nanayakkara N et al,[10] in 2020 and Shi GJ et al,[11] in 2018 where for comparison of biochemical variables in various groups of study subjects results reported by the authors in their

studies were comparable to the results of the present study.

Concerning the assessment of the correlation of BMI and other study parameters in study participants, a significant association of BMI was seen with MDA, TG, cholesterol, HbA1c, PPBG, and FBG with r-value (correlation coefficient) values of 0.387, 0.254, 0.365, 0.501, 0.254, and 0.182 respectively. These findings were in agreement with the results of Kowluru RA et al,[12] in 2015 and Nakamura M et al,[13] in 2020 where the correlation of BMI and other study parameters in study participants where the correlation of BMI and other study parameters in study participants similar to the present study was also reported by the authors in their respective studies.

CONCLUSION

Within its limitations, the present study concludes that for the management and prevention of vascular complications in subjects with type 2 diabetes mellitus, it is vital to maintain normal levels of MDA (malondialdehyde) and normal body weight. However, further large-scale and long-term studies are needed to confirm the conclusion of the present study.

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