Effect Of Hyperglycemia, Glycated Hemoglobin On Total Cholesterol And High-Density Lipoprotein In Type 2 Diabetes Subjects.

Brijendra Singh Hindoliya[1], Dr. Jaya Jain[2], Dr. Ashok Kumar Mehra[3], Dr. Bedabrata Mukhopadhyay[4]*

[1]PhD Research scholar, Mail Id singhbrijendra688@gmail.com, Department of Biochemistry, Index Medical College Hospital and Research Center, Indore, M.P.

[2]Professor, Department of Biochemistry, Index Medical College Hospital and Research Centre, Indore, M.P.

[3]Assistant professor, Dept. of Biochemistry, RKDF Medical College Bhopal, Mail ID ashokmehragwalior@gmail.com

[4]*Assistant professor, Department of Biochemistry, Santiniketan Medical College, Bolpur, Santiniketan Email: drbedabrata@gmail.com

*Corresponding Author: Dr. Bedabrata Mukhopadhyay

*Assistant professor, Department of Biochemistry, Santiniketan Medical College, Bolpur, Santiniketan Email: drbedabrata@gmail.com

Abstract

Background: Diabetes puts people at a higher risk for a wide range of microvascular and macrovascular problems.

Aim: The aim of the present was to study the effect of hyperglycemia, HbA1c on total cholesterol (TC) and High-Density Lipoprotein (HDLc) in Type 2 Diabetes mellitus (T2DM) subjects.

Materials &methods: In this case-control study, we compared a group of people with type 2 diabetes (T2DM) with a group of people without T2DM, totaling 200 people. All participants were evaluated at Index Medical College & Research Centre in Indore, India, using the center's outpatient services. The authors of the study have begun their work after receiving approval from the relevant ethics board. Each individual in this study has given their consent before the study began.

Results: Age, BMI, FBS, and HbA1c, were measured. BMI, FBS (t=6.955, d=198), HbA1c (t=10.931, d=198), shown to be significantly higher in T2DM patients compared with healthy controls. This shows that increased glucose levels may hamper the sensitivity of the insulin and as well as glycation of the proteins. On the contrary, the present study did not observe significant difference in case with the age of the subjects present in the study. TC, and HDLc, levels were shown above. TC (t=5.043, d=198) level was significantly higher in T2DM patients compared with healthy controls.

Conclusion: Reducing ROS generation may lower hyperglycemia, dyslipidemia, and oxidative stress. These advancements may result from: However, lowering oxidative stress, which causes hyperglycemia and dyslipidemia, may increase serum insulin levels, according to the study's authors.

Keywords: type 2 diabetes, dyslipidemia, serum insulin, oxidative stress and lipid profile

INTRODUCTION:

People who have diabetes are at a greater risk for a wide variety of microvascular and macrovascular problems, one of which is diabetic retinopathy, which is a well-known microvascular problem [5]. People who have diabetes are also at a greater risk for a wide variety of other problems, including heart disease and stroke. Diabetes puts people at an increased risk for a variety of other conditions, some of which can have an effect on the cardiovascular system [6]. It was

discovered that the prevalence of diabetic retinopathy in India was 17.7%, which was significantly lower than the prevalence of diabetic retinopathy in the United States (50.3%), the prevalence of diabetic retinopathy in the United Kingdom (33.6%), and the prevalence of diabetic retinopathy in Australia (29.0%) [7-10].

When one considers the staggeringly high number of people who have been given a diagnosis of having the illness, one is able to reach certain inferences about the severity of the condition [8]. The beginning of diabetic retinopathy, as well as its progression, has been linked to a number of different causes, and these factors include a variety of risk factors [9].

The process of glycation, also known as the covalent attachment of glucose to a derivative of hemoglobin, has been linked to a variety of adverse health effects (HbA1C) [1,2]. The average plasma glucose concentration that was present during a red blood cell's 120-day life cycle, which happens 4-6 weeks before a sample is collected, is what determines the quantity of HbA1c that is created [4,5]. This takes place 4-6 weeks before a sample is taken. In addition to ongoing patient monitoring through the utilization of measures such as glycated hemoglobin, it is vital that improved diagnostic parameters be created [6,7]. Lipid peroxidation, which occurs when DNA is damaged and when cells are subjected to oxidative stress, has the potential to be utilized as a biomarker for the early identification of disease as well as the evaluation of how effectively treatment is working [8]. Hence, the aim of the present was to study the effect of hyperglycemia, HbA1c on total cholesterol and High-Density Lipoprotein (HDLc) in Type 2 Diabetes Meliitus (T2DM) subjects.

MATERIALS & METHODS:

The present study is a case-control study comprised of hundred (100) subjects each in T2DM group and healthy control group. All the subjects of both groups were scrutinized from the out-patient departments of Index Medical college & research center, Indore. After taking permission from the institutional ethics committee, the authors of the study have initiated the work. Before commencing the present study and from each participant informed consent has been obtained.

Exclusion criteria: Type 1 diabetes individuals, and T2DM individuals with pathological conditions. Each diabetic and non-diabetic has no history of thyroid disorder, study exclude very ill patient with complication of diabetes, cardiovascular events or myocardial infarction, cancer and patients with endocrinological dysfunction, morbid obese.

Inclusion criteria for healthy controls were non-diabetic, not taking multivitamin supplementations, and having no other secondary pathologies. Coming to T2DM group subject not taking any antihyperglycemic drug, diuretics, fasting blood glucose level $\geq$ 126 mg/dl, glycated hemoglobin $\geq$ 6.5%, Oral glucose tolerance test $\geq$ 200 mg/dl. Fasting venous blood (5ml) were drawn into EDTA and plane vials, after informed written consent from all the study group subjects. Serum was separated by centrifuging the blood at 3000 rpm for 20 minutes and stored in aliquots at -20° C until assayed. Plasma glucose was estimated by Glucose Oxidase and Peroxidase (DPEC – GOD/POD) method purchased from Avantor laboratories. The reagents were prepared according to the instructions provided in the kit manual. HbA1C was estimated by using the ClinRep complete kit on the BioRad HbA1c analyzers Diamat and Variant and the assay was performed as per directions. Normal values are 4.5-6.1%. Serum TC was estimated by using the method of Cholesterol Oxidase and Peroxidase (CHOD/POD) purchased from Avantor Performance Materials India Limited, Dehradun, Uttarakhand, India. Serum TC was estimated by using the method polyethylene glycol (PEG) and phenol and 4-aminoantipyrine (PAP) purchased from Avantor Performance Materials India Limited, Dehradun, Uttarakhand, India. Steps were followed as per the instructions given by the supplier.

STATISTICAL ANALYSIS:

Excel 2010 spreadsheets will analyze data. SD shows variable results. All p 0.05 statistically significant tests will be analyzed using Microsoft Excel and IBM SPSS for Windows. Student independent sample t tests compare cases and controls statistically. Pearson's correlation coefficient calculated parameter correlation. $p < 0.05$ indicated statistical significance.

RESULTS:

Age, BMI, FBS, and HbA1c, were measured. BMI, FBS (t=6.955, d=198), HbA1c (t=10.931, d=198), shown to be significantly higher in T2DM patients compared with healthy controls. This shows that increased glucose levels may hamper the sensitivity of the insulin and as well as glycation of the proteins. On the contrary, the present study did not observe significant difference in case with the age of the subjects present in the study. TC, and HDLc, levels were shown above. TC (t=5.043, d=198) level was significantly higher in T2DM patients compared with healthy controls.

Table 1: Anthropometric measurements, glycemic status, TC, and HDLC of the T2DM individuals and control subjects

Variable	T2DM group (n=100)	Control group (n=100)	P- value
Age (years)	51±6.2	51±5.7	NS
BMI (kg/mt^2)	27.2±1.1	22.8±1.9	S
FBS (mg/dL)	133.4±48.7	89.7±10.8	S
HbA1c (%)	7.8±2.1	5.1±1.9	S
TC (mg/dL)	168.2 ± 28.2	144 ± 11.1	S
HDLc (mg/dL)	42.8 ± 3.9	45.3 ± 2.8	NS

Note: TC (Total Cholesterol); TAGs (Triacylglycerols); HDLc (High Density Lipoprotein); LDL (Low Density Lipoprotein Cholesterol); T2DM (T2DM Mellitus); S (Significant < 0.05); NS (Not Significant > 0.05).

In figure 1, we tried to find the association between the serum levels of TC and HDLc in healthy controls. We observed steady upward positive correlation (y = 0.902x + 36.23) between TC and HDLc in healthy controls. The Pearson correlation we observed a statistically significant association between the two variables. A positive correlation between TC and HDLc (r^2= 0.548, P<0.001 in the control group subjects.

Figure 1: Regression graph showing inverse relationship between serum TC and HDLc in control subjects.
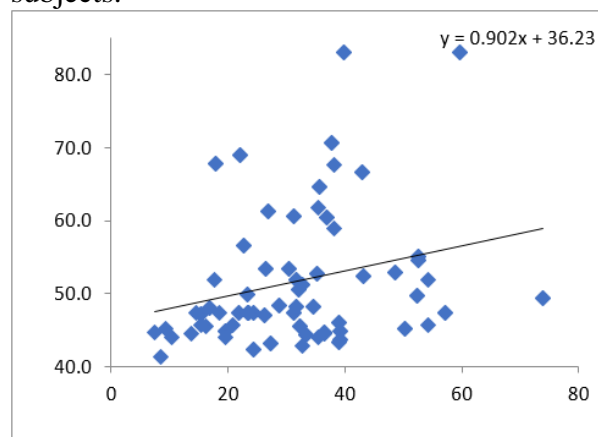
DISCUSSION:

Patients who have diabetes mellitus are evaluated based on how effectively their metabolic treatment is being carried out by using the HbA1c level as a measuring stick [1,2]. Those people who have hyperglycemia that does not go away on its own may influence the generation of reactive oxygen species, which can result in lipid peroxidation and the glycation of proteins [3,4]. It has been demonstrated beyond a reasonable doubt that diabetes-related membrane damage results in the production of lipid peroxides as a final byproduct [5]. Diabetes mellitus is the reason for this circumstance. This damage may have been caused by the attack of ROS on membranes, which is caused by high blood glucose levels [7,8]. In addition, it has been demonstrated that hyperglycemia plays a role in the process of autoxidation, which involves both lipid and protein molecules [9,10].

In the current study, the researchers found that people with T2DM had dyslipidemia. This was found to be the case when all three groups were analyzed together. Previous study has demonstrated that adipose tissue bears a larger amount of SREBP-1c overexpression than other types of tissue do in a variety of models of insulin resistance [7]. In adipose tissue, it has been demonstrated that this is indeed the case [8]. These mice are included in this category of models, along with the leptin-deficient obese ob/ob mice and the lipoatrophic mice [9]. Insulin receptor substrate-2 (IRS-2) knockout animals, which are animals in whom insulin signaling is damaged in some way, display an increased production of hepatic SREBP-1c lipogenic transcription factors [10]. These animals are known as insulin signaling knockout animals [2-4]. In addition, it was discovered by [11 that the activation of SREBP-1c did not require the presence of insulin in mice that had their insulin levels lowered and were given STZ [12]. Insulin resistance also has an effect on lipids because it increases the number of genes that code for essential enzymes that are involved in the process of lipid metabolism [8,13,14]. This is another way that insulin resistance can affect lipids. Because of this, the lipid profile becomes abnormal [15]. Insulin is known to stimulate an increase in the production of HDL and apolipoprotein A by the liver [16]. This connection has been extensively proven. It is a well-established fact that high-density lipoprotein, often referred to as HDL in some circles, belongs to the class of lipoproteins [17]. In addition to being responsible for the transfer to other lipoproteins, high-density lipoprotein, or HDL, oversees transporting cholesterol to the liver [18-20]. It becomes more challenging for HDL secretion to take place when insulin resistance is elevated because this pathway is inhibited, which has the consequence of raising insulin resistance [20,21]. According to these findings, insulin resistance, in addition to an elevated glucose level that was derived from insulin resistance, contributed to an increase in the creation of TC levels in the current investigation [15,22,23]. These findings came about as a result of the investigation into the relationship between insulin resistance and glucose levels [22]. The investigation focused on the connection between insulin resistance and high glucose levels, which led to the discovery of this finding as a result of that investigation [21,23]. Researchers [21,25] all came to the same conclusion: T2DM is a common metabolic illness that is associated with a dramatic modification in lipid and lipoprotein profiles. This conclusion was reached independently by each group of researchers. Each of the researchers arrived at their own unique interpretation of the data [23]. As a result of this, it is reasonable to anticipate that the disturbance in the anabolic process that was observed in T2DM patients. This is because of the fact that it is reasonable to anticipate that this disturbance will lead to a reduction in the level of HDLc [24]. This decrease could be attributed to an increase in the synthesis of cholesterol as well as a reduction in the use of [1,25]. A positive correlation between TC and HDLc which implies that as the cholesterol level increases the transporter which is HDLc increases in order to compensate the increase by reverse cholesterol transport in controls.

CONCLUSION:

A decrease in the body's production of reactive oxygen species (ROS) may lead to reductions in the levels of hyperglycemia, dyslipidemia, and oxidative stress. The following factors could lead to these advancements: On the other hand, the study's authors might be able to draw a link between the study's results and the potential for improved serum insulin levels by lowering oxidative stress, which would otherwise lead to hyperglycemia and dyslipidemia.

Conflict of interest:

The present study authors do not have any conflict of interest among themselves.

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