EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 10
Issue: 11
132-136
Year: 2023

STUDY ON HbA1C AND URINE SUGAR IN DIABETIC PATIENTS OF NORTH REGION (PUNJAB)

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Article Received on 29/08/2023 **Article Revised on 19/09/2023** **Article Accepted on 09/10/2023**

ABSTRACT

Background: Glycated haemoglobin or glycosylated haemoglobin (HbA1c) is a form of haemoglobin that is measured primarily to identify the average plasma glucose concentration over prolonged periods of time. Levels of HbA1c represent the average blood glucose levels of diabetic patients over the previous 120 days. The objective of this study was to see the HbA1c and urine sugar level in diabetic patients in north region Punjab. During study, we have estimated glycosylated hemoglobin (HbA1c) in diabetic and non diabetic person and correlated with urine sugar levels. **Materials and Methods:** A study of glycosylated haemoglobin and urine sugar was conducted in a total number of 90 subjects among which 40 subjects are as control (non-diabetic at the time of study) and 50 diabetic patients who were on treatment. **Results:** The patients whose urine sugar was nil still have high value of HbAIc. Moreover the age affects the sugar levels. **Conclusion:** Study concluded that diabetic subjects had higher value of HbA1c than non diabetic subjects. Long term diabetic complications were more related to glycosylated haemoglobin.

KEYWORDS: Glycosylated hemoglobin, Diabetes, Urine sugar, lifestyle, obesity.

INTRODUCTION

Diabetes mellitus (DM) is a metabolic disorder that leads to chronic hyperglycemia and impaired carbohydrate, fat, and protein metabolism caused by insulin secretion defects and/or peripheral insulin resistance.[1] The DM epidemic is one of the most extensive global health emergencies of the 21st century. Diabetes mellitus is aggravated by and associated with metabolic complications that can subsequently lead to premature death.[2] Globally, the prevalence of diabetes is estimated to increase to 9.9% (522 million) by 2030, up from 8.3% (366 million) in 2011. When a patient fails to maintain the insulin level, it triggers other metabolic impairments (hypertension, cardiovascular disease, Obesity), pathological conditions, and insulin deficiency/ resistance.[3]

The presence of DM shows increased risk of many complications such as cardiovascular diseases, peripheral vascular diseases, stroke, neuropathy, renal failure, retinopathy, blindness, amputations etc.[4] Drugs are used primarily to save life and alleviate symptoms. Secondary aims are to prevent long-term diabetic complications and by eliminating various risk factors, to increase longevity. Insulin replacement therapy is the mainstay for patients with type 1 DM while diet and lifestyle modifications are considered the cornerstone for the treatment and management of type 2 DM.[5] Various types of hypoglycemic agents such as Biguanides and Sulfonylureas are also available for treatment of diabetes. However none of these medications is ideal due to their toxic side effects and diminution of responses is observed sometimes in their prolonged use.[6]

Classification of diabetes mellitus

The first most widely accepted classification of diabetes mellitus was published by WHO in 1980 and modified in 1985.[7,8]

Classification of diabetes mellitus is described as below

1: Type I Diabetes Mellitus: The condition is also called autoimmune diabetes and was previously known as juvenile-onset or ketosis-prone diabetes. The onset of type I diabetes mellitus, also known as insulin-dependent diabetes mellitus (IDDM), is usually sudden and life-threatening.[9] In type 1, beta-cell destruction is associated with anti-glutamic acid decarboxylase antibodies, islet cells, or insulin antibodies.[10] Due to destruction of ß-islets in the pancreas, insulin is not secreted. So, it is given externally like with injections of insulin.[11]

2: Type II Diabetes Mellitus: Type 2 diabetes is a major public health problem worldwide, which strains healthcare systems. It is a progressive diseases characterized by the severe complications, such as strokes and cardiovascular disease.[12,13] Complications associated with type 2 diabetes can be prevented or at least postponed by the diligent care of the ailment.[14] This includes maintaining healthy glycemic and lipid levels and keeping blood pressure under control by self-management and regular monitoring.[15]

According to the Finnish Current Care Guidelines for diabetes[16] the glycated Hemoglobin (HbAIc) level should be lower than 7.0% (53 mmol/mol), measured with a measurement frequency of once or twice a year. The recommended level for low density lipoproteins (LDLs) is $\leq$2.5 mmol/I and it should be measured at least once in one to 3 years.

3. Gestational diabetes mellitus: When glucose intolerance occurs for the first time during pregnancy or is diagnosed, it is called gestational diabetes mellitus (GDM). In most women who develop GDM, the disorder has its onset in the third trimester of pregnancy. At least 6 weeks after the pregnancy ends, the woman should receive an oral glucose tolerance test and be reclassified as having diabetes, normal glucose tolerance, impaired glucose tolerance, or impaired fasting glucose. Gestational diabetes complicates about 8-9% of all pregnancies, though the rates may double in populations at high-risk for type 2 diabetes.[17]

Glycated haemoglobin

Glycated haemoglobin (HbA1c, HbA1C, or HbIc; also known as HGBA1c) is an intermediate form of hemoglobin used to measure long-term average plasma glucose levels. It is being observed that it is formed in a non-enzymatic glycation pathway by hemoglobin's exposure to plasma glucose. HbA1c is a measure of the beta-N1-deoxy fructosyl component of hemoglobin.[18,19] An irreversible glycation at one or both of the N-terminal valines of the beta chains is defined as HbA1c.[20] HbA1c has been the mostly used and accepted test for monitoring the glycaemic control in individuals with diabetes.Glycated haemoglobin molecule remains in the red blood cell for the rest of its lifespan (120 days). An isoelectric focusing method or electrophoresis is usually used to measure HbA1c, which consists of three different glycations.[21] The relative proportion of HbA1c depends on the mean glucose level over the previous 120 days.[22]

HbA1c is a reliable indicator of diabetic control except in the following situations: Situations where the average RBC lifespan is significantly less than 120 days will usually give rise to low HbA1c results because 50% of glycation occurs in 90-120 days.

Urine Sugar

Urine is a by-product of kidney metabolism and is rich in many nitrogen-containing substances, including urea, uric acid and creatinine, which are excreted from the body as water-soluble chemicals during urination.[23-24]

A glucose in urine test measures the amount of glucose in the urine. A hormone called insulin helps move glucose from bloodstream into cells. If too much glucose gets into the blood, the extra glucose will be eliminated through urine. A urine glucose test can be used to help determine if blood glucose levels are too high, which may be a sign of diabetes.

MATERIALS AND METHODS

This study was held at Department of Laboratory Medicine, Global Heart Super Specility Hospital, Ludhiana. In this study, A total number of 90 subjects participated among those 40 were non-diabetic (control) at the time of study and 50 were diabetic patients who were on treatment. The selected subjects included both males and females in the age group of 20 - 78 years. 50 patients (Group B) were taken up for the study along with 40 healthy individuals as controls (Group A).

Parameters evaluated in present study

1. HbA1c
2. Urine sugar

Principle for HbA1c test

The arrangement of the two light sources and associated detectors allow the device to be used as a dual channel spectro – photometer / flourimeter. This allow the device to be used either to measured changes in optical density as used in immune turbidimetric assays or changes in light transmission from specific fluoriphores as they interact with analytese HbA1c.[25]

Procedure

The analyzer is ready to perform a test when the device displays the home screen's time, date, and message, "Scan Lot code."

↓

Take out a tray of cartridges and keep it at room temperature for 50 minutes.

↓

To begin the test, the analyzer prompts the user to scan the calibration barcode. Continue the scanning until a beep is heard.

↓

Take the cartridge out of the tray. Avoid touching the cartridge's bottom.

↓

Make sure the reagent bead is still in the top of the cartridge as you carefully remove the lid. The cartridge must be used within one minute of the foil top being removed.

↓

The analyzer cartridge should be inserted. The message "Cartridge Inserted" will be shown after the analyzer detects the cartridge. Running' The cartridge will undergo an optical inspection by the analyser.

↓

Use the sample stick's blunt end to put the reagent bead into the vial when instructed to "Insert Reagent." This procedure takes about 50 seconds.

↓

Both finger stick blood samples and venous whole blood obtained with EDTA can be used with the analyzer. The sample stick will be used to draw blood.

↓

When the analyzer display the message 'insert sample and close door', gently insert the sample stick, containing the blood sample

↓

Close the analyzer door fully to complete the intro of the sample stick into the cartridge. There is a time limit of 60 sec. to insert sample stick.

↓

When test has finished the results will be displayed in the screen and printed on printer.

Strip Method

The test method consists of immersing the test strip completely in a well mixed sample of urine for a short period of time, then extracting it from the container and supporting the edge of the strip over the mouth of the container to remove excess urine. The strip is then left to stand for the time necessary for the reactions to occur (usually 1 to 2 minutes), and finally the colors that appear are compared against the chromatic scale provided by the manufacturer. An improper technique can produce false results, for example, leukocytes and erythrocytes precipitate at the bottom of the container and may not be detected if the sample is not properly mixed, and in the same way, if an excess of urine remains on the strip after it has been removed from the test sample, may cause the reagents to leak from the pads onto adjacent pads resulting in mixing and distortion of the colors. To ensure that this does not occur it is recommended the edges of the strip are dried on absorbent paper.[26]

RESULT AND DISCUSSION

Data collected from 90 patients is screened for HbAIc and strip test and it was found that 40 patients were having no sugar in urine but the HbAIc test revealed that those patents were having pre diabetic history. Moreover the result also varies with age as shown in tables below.

Control Group

Control group included 40 non diabetic normal subjects. Out of these 40 normal subjects, 24 were male and 16 were females, mean age of them was 40.63 years. (Range: 20-78 years) Mean HbA1c value in this group was 6.66. Range was 5.7 to 7.8.

Study Group

These included all 50 diabetic patients and of these 31 were male and 19 were females. Mean age of them was 44.14 (Range- 20-78 years).

Table 1: Control Group (Group- A)

Group (A)	No. of subjects	Hba1c mean	Urine sugar mean
Control T	40	6.63	0
M	24	6.61	0
F	16	6.1	0

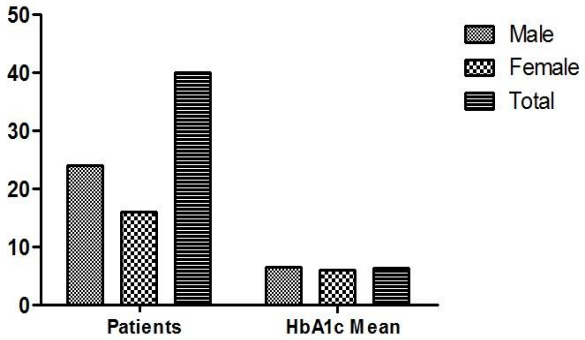

Figure 1: Graph with HbA1c mean for Control Group

Subject Group: (Group –B)

This included all 50 diabetic patients and of these 31 male and 19 were females. Mean age of them was 44.14 (range-14-75years).

Table 2: Subject Group (Group-B)

Group (B)	No of subjects	HbA1c mean
Study Case T	50	9.13
M	31	9.17
F	19	9.14

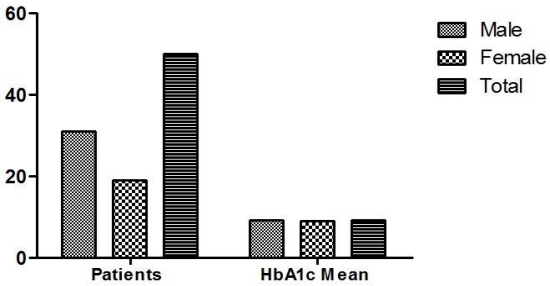

Figure 2: Graph with HbA1c mean for Subject Group

Table 3: Subject Group (Group-B)

Group (B)	No.	Urine sugar mg/dl
Study Case T	50	351
M	31	345
F	19	308

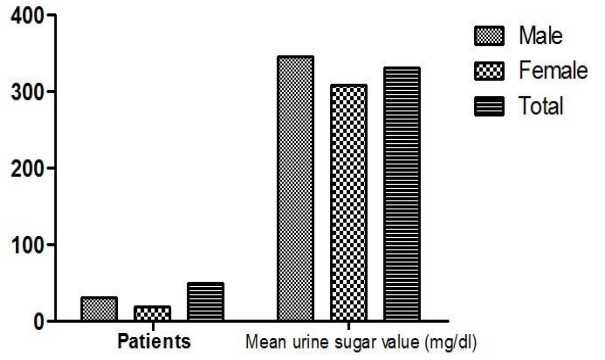

Figure 3: Graph with mean urine sugar value in subjects

Age Distribution

In Control group mean age was 44.14 years and in this group the maximum number of patients were in 60-78 year age group. The minimum age being 20 years and maximum age was 78 years.

Table 4: Age Distribution: Control Group (Group-A)

Age Group	No. of subjects	Male	Female	Total
	50			
20-30		4	4	8
31-40		5	4	9
41-50		1	3	4
51-60		11	2	13
60-78		3	3	6
Total		24	16	40

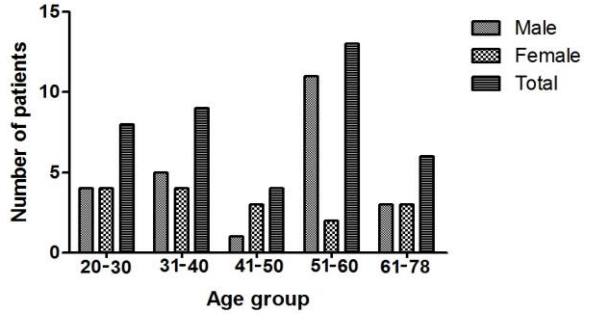

Figure 4: Graph of distributions of Control Group (Group-B)

Table 5: Age Distribution: Subjects Group (Group-B)

Group	No. of subjects	Male	Female	Total
Case	50			
20-30		1	2	3
31-40		0	2	2
41-50		4	1	5
51-60		12	6	18
61-78		14	8	22
Total		31	19	50

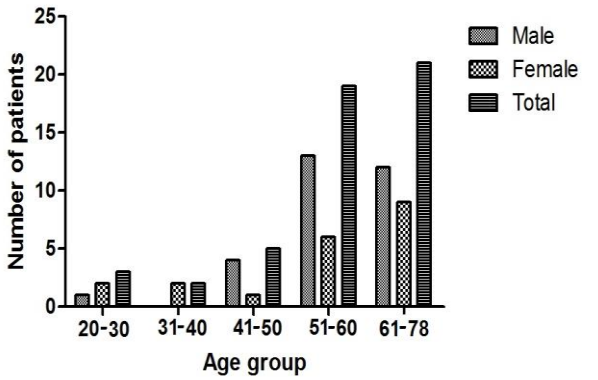

Figure: 5 Graph of Age Distributions of Subjects Group

DISCUSSION

This study was conducted on Control group (A) of 40 non diabetic persons and Study group (B) of 50 diabetic patients to find relation of glycosylated hemoglobin and different aspects of diabetes mellitus. In this study various aspects of diabetes like various parameters on levels of Glycosylated hemoglobin was studied and levels of urine sugar measured by strip method.

In control group (non-diabetic,40) mean HbA1C was 6.66 and (range from 5.7% to 7.8). In diabetic patients (50) mean HbA1c value was 12.28 % so this was this clearly reflected that HbA1c values in diabetic patients are 2 to 3 times higher than non-diabetic patients. Higher glycosylated hemoglobin values were in old age groups 60 to 78 years and levels were high than younger patients seen in age group of more than 40 years (41 to 75 years. Mean value of GHb was high in male patients (13.57%) than mean values of female patients (12.10%).

The level of GHb increases progressively as the duration of diabetes increase. Though patients having newly detected diabetes cases and in initial periods show increased levels of GHb. Patients on Insulin therapy had higher values of GHb (13.08%). Patients on oral hypoglycemic drugs had HbA1c determination may provide an alternative method of screening for diabetes. This is an attractive concept because HbA1c level can be measured from a single blood sample taken at any time of day without prior dietary preparation and yet provide highly representative measure of the average blood glucose concentrations. In contrast the HbA1c determination has low sensitivity but high specificity.[27] These finding in present series confirmed the results of previous study that HbA1c can be used as screening procedure for detection of diabetics. Diabetes mellitus, a common metabolic disorder, which accounts for a high incidence of morbidity leads to various events including micro and macro vascular complications. Glycosylated hemoglobin assay is superior to the traditional blood sugar values in discriminating diabetic from non-diabetic patients. There is overlap of the diabetic and non diabetic HbA1c value in 8 cases (2.28%) out of 50 patients.

CONCLUSION

Diabetes mellitus is a group of metabolic disorders in which blood sugar levels remains high for a longer period of time. From this study it is concluded that people having diabetes are more prone to cardiovascular diseases. Hence, lifestyle also affects the health of heart. Modifications in diet along with healthy lifestyle can strengthen the heart and minimize the effect of diabetes on it. Novel drugs are being developed, yet no cure is available in sight for the disease, despite new insight into the pathophysiology of the disease.

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