# Comparative Assessment Of Fasting Plasma Glucose And Hba1c Values In Type Ii Diabetes Mellitus In A Tertiary Care Hospital

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***Abstract*- Background:** Diabetes is a growing public health problem throughout the world. As a consequence of hyperglycemia in diabetes, every tissue and organ of the body undergoes biochemical and structural alterations which accounts for major diabetes complications. The prevalence of Type II Diabetes mellitus is rising more rapidly because of obesity and reduced physical activity levels as countries, become more industrialized.

**Aim and Objective:** To determine the levels of glycosylated hemoglobin (HbA1c) and fasting plasma glucose (FPG) in patients with Type II Diabetes mellitus and to compare with healthy controls and also the study of the correlation between Fasting plasma glucose and HbA1c levels in diabetic patients.

**Material and Methods:** In this study total of 138 subjects were included. 69clinically diagnosed type 2 diabetic patients and 69 normal subjects were recruited as control. HbA1c and fasting blood glucose levels were measured by the methods of HPLC and Hexokinase respectively.

**Results:** The mean value of HbA1c in Type II diabetic patients was significantly higher than in the controls. The mean value of fasting blood glucose levels was significantly higher in type 2 diabetics when compared with controls and a significant correlation was observed between levels of fasting plasma glucose and HbA1c in diabetic patients.

**Conclusions:** The diagnostic potential in diabetes is enhanced when both HbA1C and FPG are used in combination. And hence this strategy is useful in assessing the status and therapeutic progress of diabetes mellitus.

***Index Terms*-** Type II Diabetes mellitus, HbA1c, fasting plasma glucose

## I. Introduction

Diabetes is a metabolic disorder characterised by chronic hyperglycemia along with significant long term complications. The term "diabetes" was coined by Araetus of Cappodocia as early as 81-133AD. Later in 1675 the term "mellitus" (honey sweet) was added to "diabetes" by Thomas Willis as the urine of these patients were found to be sweet. In 1776 Dobson confirmed that the 'sweetness' was due to the presence of excess sugar in urine and blood of these individuals. Subsequent years witnessed various significant developments in the history of Diabetes mellitus. The roles of liver and pancreas in glucogenesis and pathogenesis of diabetes were such important milestones. In 1921 Banting and Best isolated insulin and explained its clinical utility in diabetes. Diabetes mellitus (DM) can be broadly divided into two categories- Type I and Type II. In type I diabetes mellitus, there is complete deficiency of insulin secretion. This deficiency may be due to an autoimmune destruction occurring in the β -cells of islets of Langerhans of pancreas. This form of diabetes, accounts for only 5–10% of those with diabetes and is also termed insulin dependent diabetes (IDDM) or juvenile-onset diabetes. The reason for the cause of autoimmune destruction is still poorly explained and could be due to genetic predispositions and also environmental factors. Ketoacidosis is an important complication noted in type I diabetes. These patients are also prone to other autoimmune disorders such as Graves' disease, Hashimoto's thyroiditis, Addison's disease, vitiligo, celiac sprue, autoimmune hepatitis, myasthenia gravis, and pernicious anemia. Type II diabetes mellitus which accounts for 90–95% of those with diabetes is also referred to as non–insulin-dependent diabetes (NIDDM) or adult-onset diabetes. It results due to a combination of resistance to insulin action and an inadequate compensatory insulin secretory response. Age, obesity and lack of physical activity are predisposing factors of developing type II DM. Women with history of diabetes during pregnancy are also more prone to develop this disease. In contrast to type 1 diabetes, autoimmune destruction of β -cells does not occur. Hyperglycemia which is the cardinal feature of type II diabetes, persist for a long period of time and can cause pathologic and functional changes in various target tissues. Symptoms described in type II diabetes are polyuria, polydypsia and polyphagia. Obesity is an important feature noted in majority of these patients. Patients who are not obese by traditional weight criteria may have an increased percentage of body fat distributed

predominantly in the abdominal region. Ketoacidosis seldom occurs spontaneously in this type of diabetes and when seen, it usually arises in association with the stress of another cause such as infection. As the development of hyperglycemia is gradual this form of diabetes frequently goes undiagnosed for many years and such patients are at increased risk of developing macrovascular and microvascular complications. The increased glucose load in these patients should normally stimulate increased secretion of insulin from the pancreas. But as patients with this form of diabetes have abnormal beta cells, their insulin levels do not rise as expected which results in insulin resistance. Insulin resistance is defined as an abnormality in which the peripheral tissues are resistant towards the action of insulin. It is an integral feature of the metabolic syndrome and most often progresses to Type II Diabetes mellitus. (1)Complications of diabetes can be acute or chronic. Acute and potentially dangerous complications are hyperglycemia with ketoacidosis or nonketotic hyperosmolar syndrome. Long-term complications include retinopathy leading to visual impairment; nephropathy leading to renal failure; peripheral neuropathy with risk of foot ulcers, amputations, and Charcot joints; and autonomic neuropathy causing gastrointestinal, genitourinary, and cardiovascular symptoms and sexual dysfunction. Patients with diabetes have an increased incidence of atherosclerotic cardiovascular, peripheral arterial, and cerebrovascular disease. Hypertension and abnormalities of lipoprotein metabolism have also been associated with diabetes.

## DIAGNOSIS OF DIABETES MELLITUS

| **Criteria for the diagnosis of diabetes – ADA 2014** |
|---|
| HbA1c ≥ 6.5. The test should be performed in a laboratory using a method that is NGSP-certified and standardized DCCT assay |
| **OR** |
| FPG ≥126mg/dl. Fasting is defined as no caloric intake for at least the past 8 hrs |
| **OR** |
| Two – hours PG ≥ 200 mg/dl during an OGTT. The test should be performed as described by the WHO, using a glucose load containing the equivalent of 75g of anhydrous glucose dissolved in water |
| **OR** |
| In a patient with classic symptoms of hyperglycemia or hyperglycaemic crisis, a random plasma glucose≥200mg/dl |

**HbA1c for diagnosis of DM**

The most commonly used assay to measure chronic hyperglycemia is HbA1c test. Glycated hemoglobin or HbA1C indicates the average blood glucose levels over a 2- to 3-month period of time. Initially this was not used as diagnostic criteria of diabetes as the assay was not standardised adequately. HbA1c test are performed using different methods like High performance liquid chromatography, affinity chromatography, cation exchange chromatography, Ion- exchange chromatography, isoelectric focussing, radioimmunoassay spectrophotometric assay, electrophoresis and electro spray mass spectrometry. But now this assay is highly standardized and hence it can be utilised as a biomarker. It plays a critical role in the management of the patient with diabetes, since it correlates well with both microvascular and, to a lesser extent, macrovascular complications. After ADA 2010 recommendation there has been a gradual increase in acceptance of HbA1c as a diagnostic test for diabetes mellitus

| **Hemoglobin A1c (%)** | **Degree of glucose control** |
|---|---|
| >8 | Action suggested |
| <7 | Goal |
| <6 | Non-diabetic level |

Estimation of HbA1C should be performed using a method that is certified by the National Glycohemoglobin Standardization Program (NGSP) and standardized or traceable to the Diabetes Control and Complications Trial reference assay (DCCT). Point-of-care A1C assays are not sufficiently accurate at this time to use for diagnostic purposes.

Glycemic control is the key strategy in managing diabetes. Many prospective clinical trials in have clearly shown that achieving glycemic control or reducing hyperglycemia significantly decrease the microvascular complications of diabetes. Each 1% reduction in haemoglobin HbA1c was associated with a 37% decrease in risk for microvascular complications and a 21% decrease in the risk of any end point or death related to diabetes. (3, 4)

Even though the ADA criteria advices the measurement of either of FBS or HbA1C foe diagnosis it would be better to combine these two parameters as each one carries its own merits and demerits. Fasting plasma glucose is considered as a valid test for diagnosing people with type II diabetes when we have a patient with 2 discrepant HbA1c results. In this situation, a fasting glucose test may be used to clarify the diagnosis. (24) But it is a fact that measurement of glucose itself is less accurate and precise than most clinicians realize (6). There are some potential pre-analytic errors owing to sample handling and the well-recognized labiality of glucose in the collection tube at room temperature (7,8). This is because studies have shown that storage of samples at room temperature for as little as 1 to 4 h before analysis may result in decreases in glucose levels by 3–10 mg/dl in non diabetic individuals (7,8,9,10). The fact that the HbA1c values are more over stable after collection (11), and the introduction of a new reference method to calibrate all HbA1c assay instruments, has improved HbA1c assay standardization in most part of the world (12,13,14). The variability of HbA1c values is also considerably less than that of FPG levels, (15,16,17). The convenience for the patient and ease of sample collection for HbA1c testing (which can be obtained at any time, requires no patient preparation, and is relatively stable at room temperature) compared with that of FPG testing (which requires a timed sample after at least an 8-h fast and which is unstable at room temperature) support using the HbA1c assay to diagnose diabetes. At the same time it also possess certain disadvantages like increased cost so that providing the assay for its routine use can be an important limitation in India. Another drawback is that any condition that changes red cell turnover, such as haemolytic anaemia, chronic malaria, major blood loss, glucose-6-phosphate dehydrogenase deficiency, sickle cell anaemia or blood transfusions, will lead to spurious HbA1c results. Thalassaemias, hereditary persistence of fetal haemoglobin, renal insufficiency, malignancy, iron deficiency anaemia, vitamin B12 and folate deficiency and splenectomy can alter the HbA1C values. (18,19,20).

There are many reports showing the acceptable correlation between HbA1C level and fasting blood glucose (FBS) level. Hence the aim of our study was to assess, whether HbA1C and Fasting plasma glucose levels correlated in type II diabetes mellitus.

## II. REVIEW OF LITERATURE

According to the International Diabetes Federation, an estimated 381 million people had diabetes in 2013(25). Its prevalence is increasing rapidly, and by 2030, this number is estimated to be almost double (26). Apart from genetic predisposition, the increase in incidence of type II DM in developing countries could be due to the drastic changes in life style of individuals.

India has more diabetics than any other country in the world. The more recent data of Indian Heart Association suggest that India is the diabetic capital of world with a projected 109 million individuals with diabetes by 2035.(27) and a study by American Diabetic Association reports that India will see the greatest increase in people diagnosed with diabetes by 2030(25,26). Currently, the disease has affected more than million peoples in India (28, 29)

Ran AL et al (1979) conducted a study in which HbA1C levels were assayed by chromatography in 167 patients undergoing glucose tolerance test (GTT) and in 105 patients who have been diagnosed with type II diabetes. In 95 % of patients with normal GTT level, the HbA1c level was in the range of 6.8% to 9.8%. High levels of HbA1C were observed in patients with poorly controlled diabetes .According to their study, in patients with normal GTT values the HbA1c levels correlated positively with fasting plasma glucose and glucose tolerance value. Significant correlation was also observed in patients with abnormal GTT results or diabetes. (30)

Rahman MA et al (1990) studied the extent of non enzymatic glycosylation in 85 diabetic patients with or without chronic complications. They found out that the fasting plasma glucose was increased in all diabetic patients and correlated significantly with glycosylated haemoglobin, glycosylated plasma proteins and serum fructosamine concentration. (31)

Bonora E et al (2001) conducted a study in which one of their objectives were to evaluate the relationship between plasma glucose level and HbA1c in non insulin treated type II diabetic subjects. Their results showed that HbA1c is more related to preprandial than post prandial plasma glucose levels. (32)

Goudsward et al (2004) conducted a study in which they tried to find out which characteristics of type II diabetes patients treated in primary care predict poor glycemic control. They concluded that FPG appeared to be a strong predictor of HbA1c, which underlines the usefulness of this simple test is daily diabetes care.( 9,33).

A prospective study done by Arthur FKN in 2005 involved assessing the FBG and HbA1c levels of diabetes mellitus patients as an index of glycaemic control. High levels of HbA1C were noted in majority of the patients and they came to the conclusion that there was a linear correlation between the fasting blood glucose and HbA1c. (34)

Peter R et al conducted a study to analyse the relationship between HbA1c and other indices of glycemic status in newly diagnosed subjects with type II diabetes. 262 patients were involved and were divided into three subgroups according to their HbA1c levels - Group 1: ≤ 7.0%; Group 2: 7.1-9.0%; and Group 3: > 9.0% .They found out that HbA1c was more strongly correlated with the fasting plasma glucose than the overall postprandial glucose exposure.(35)

A study by Svendsen P et al (2009) evaluated the usefulness of HbA1c determination in the diagnosis of diabetes mellitus. The prevalence of elevated fasting plasma glucose and abnormal OGTT were found to increase with increasing age. In their study, 16% of individuals with normal OGTT had fasting plasma glucose concentration above the upper normal limit and high HbA1c values were found in subjects with high fasting plasma glucose.(12,36)

Chi-Chau Liang et al (2010) studied the relationship of fasting glucose and HbA1c and attempted to establish a conversion equation between them. They analysed 3411 cases enrolled during 4 years period. The fasting blood sugar and HbA1c data of each case was collected. It was seen that the HbA1c values among the general healthy population tends to be higher as age increases. According to the regression coefficient from their study, the fasting glucose that corresponds to 6% HbA1c was 108.2mg/dl. (37)

Ghazanfari Z et al (2010) assessed the association between HbA1c and FBS through a cross-sectional population-based study. Samples of 604 peoples were collected and their HbA1c and fasting blood sugar were tested. The association between HbA1c and FBS, their sensitivity, specificity and predictive values in detection of abnormal values of each other were determined. Results showed that the association of HbA1c with FBS was relatively strong particularly in diabetic subjects. It was also seen that FBS was a more accurate predictor for HbA1c compared with HbA1c as a predictor of FBS. Although the optimum cut off point of HbA1c was >6.15%, its precision was comparable with the conventional cut off point of> 6%.(38)

Shrestha L et al (2012) conducted a cross sectional study to determine the correlation between glucose monitoring by fasting blood glucose or two hours postprandial blood glucose with glycated haemoglobin (HbA1c) in type II diabetic patients. 60 inpatients with type 2 diabetes mellitus were assessed for HbA1c, daily fasting and postprandial blood sugar for 15 consecutive days. According to their study results both postprandial blood glucose and fasting blood glucose significantly correlated with HbA1c. (39)

Baura A et al (2014) examined FPG and HbA1c of type II diabetes mellitus patients in 4 and 8 weeks after starting treatment and determined liner and nonlinear regression between these two parameters. They concluded that the corrected HbA1c is a better predictor of the corresponding Fasting Plasma Glucose and a steady state excellent regression exerts between HbA1c and FPG. (40)

Swetha N K et al (2014) aimed to find the correlation between HbA1c with FBS, PPBS & RBS so as to assess their usefulness in monitoring glycemic control in diabetic patients. The study population was divided into three groups based on the HbA1c values i.e. Group 1

(HbA1c < 7% - good control) Group 2 (HbA1c 7-9% -fairly controlled), Group 3 (HbA1c >9% -Poorly controlled). They found that there was a significant correlation between HbA1c & FBS, PPBS & RBS in the study population, and there was a direct correlation between FBS, PPBS & HbA1c levels in both controlled & uncontrolled diabetic patients, (41)

Kaur et al (2014) studied the correlation between glycated hemoglobin and fasting/random blood sugar levels for the screening of diabetes mellitus. It was a retrospective observational study conducted in 600 already diagnosed patients of diabetes mellitus who came for a regular check-up of fasting/random blood sugar and glycated hemoglobin levels. The mean ±SD of Hba1c, FBS, and RBS levels were 8.84 ±2.5%, 159.84 ±79.6 mg%, and 241.18 ± 103.8 mg% respectively with an insignificant difference between males and females. Their study results show, there was an excellent correlation between Hba1c and FBS (r=0.755), (42)

A study conducted by Asmita P.B et al( 2014), the aim of their study was to determine the levels of glycosylated hemoglobin (HbA1C)and fasting blood glucose (FBG) in patients with type II diabetes mellitus and to compare with healthy controls and also to find out the correlation between fasting blood glucose and HbA1C levels in diabetic patients.40 clinically diagnosed type II diabetic patients and 40 normal subjects were recruited as control. Their results show that the mean value of HbA1c in type II diabetic patients was significantly higher than in the controls. The mean fasting blood glucose levels were significantly higher in type II diabetics when compared with controls and significant correlation was observed between levels of fasting blood glucose and HbA1c in diabetic patients .(43)

## III. MATERIALS AND METHODS

The study was conducted as a cross-sectional prospective study. Blood samples were collected from the Clinical Biochemistry Laboratory attached to the hospital. The study consisted of 68 diabetic individuals.

**Subjects**

The study was conducted over a period of 6 months from October 2015 to March 2016 and included 68 individuals diagnosed with diabetes based on ADA criteria. Based on the available literature on HbA1c, and fasting plasma glucose with 95% confidence and 80% power, the minimum sample size came to be 68.

Method of collection of data is based on inclusion and exclusion criteria.

**Inclusion Criteria:**

1. Age group 35 – 60 years
2. Patients diagnosed with Type II Diabetes Mellitus based on ADA criteria (FPG> 126mg/dl OR HbA1C ≥ 6.5%)

**Exclusion Criteria:**

- Age < 35 and > 60 years
- Patients diagnosed with anemia, malaria and haemoglobinopathies.
- Patients with hypertension, proven cardiovascular, renal, thyroid or hepatic disorders

## IV. METHODOLOGY

**Study Parameters**

Fasting plasma glucose
HbA1c

**Sample collection**

The blood samples were obtained under aseptic precautions. Blood was collected in grey vacutainers for the estimation of fasting plasma glucose after 10-12 hours of fasting. These samples were centrifuged at an RPM of 3000 for 5 minutes for separating the serum. Simultaneously, the whole blood was collected in a violet vacutainer containing EDTA for the estimation of HbA1c.

## V. ESTIMATION OF FASTING BLOOD GLUCOSE

Fasting Blood Glucose was estimated by enzymatic UV test (Hexokinase method)

**Principle**

Glucose is phosphorylated by Hexokinase in the presence of adenosine diphosphate (ADP). Glucose -6 –phosphate dehydrogenase (G6PDH) specifically oxidizes glucose 6 phosphates to gluconate 6 phosphates with the concurrent reduction of NAD+ to NADH. The increase in absorbance at 340 nm is proportional to the glucose concentration in the sample.

**Linearity**

800mg/dl

**Measuring interval**

10-800mg/dl

**Interferences**

Ascorbate : interferences less than 3% up to 20 mg/dl ascorbate
Icterus: interferences less than 10 % up to 40% bilirubin
Haemolysis: interferences less than 3% up to 5 gm /l haemoglobin
Lipemia: interferences less than 10% up to 100 mg/dl

**Biological reference intervals**

Fasting; 70 -110 mg/dl

**ESTIMATION OF HbA1c**

**Principle**

Estimation of HbA1c was performed using D-10 Haemoglobin A1c program, which utilizes principles of ion exchange high performance liquid chromatography (HPLC).

**Linearity**

HbA1c level of 18.5%

**Interferences**

Icterus are indicated by bilirubin concentration up to 20 mg/dl does not interfere with the assay
Lipemia as indicated by triglyceride concentration up to 5680mg/dl does not interfere with the assay
HbF concentration up to 10 % do not interfere with the assay
Labile A1c concentration up to 4 % do not interfere with the assay
Carbamylated Hb (CHb) concentration up to 35% do not interfere with the assay

**Reference interval**

| Haemoglobin A1c (%) | Degree of glucose control |
|---|---|
| >8 | Action suggested |
| <7 | Goal |
| <6 | Non-diabetic level |

**Statistical analysis**

- Statistical analysis was performed using IBM SPSS version 20.
- For all continuous variables the results are given in mean ± standard deviation
- To compare the means of fasting plasma glucose between two groups, the Mann-Whitney test was applied
- To compare the means of HbA1C between two groups, an independent two-sample t-test was performed.
- Pearson's correlation coefficient was used to find out the correlation between fasting plasma glucose and HbA1c
- Probability value (p) ≤ 0.05 is considered for statistical significance.

## VI. RESULT

**Table-1: Mean distribution of Fasting plasma glucose (FPG) in cases and controls**

| Groups | N | FPG | | p Value |
|---|---|---|---|---|
| | | Mean | SD | |
| Control | 69 | 102.55 | 18.79 | 0.001 |
| Case | 69 | 184.52 | 75.18 | |

Mean Fasting plasma glucose was found to be significantly high in cases than controls.

**Fig:1 Graph showing the mean distribution of Fasting plasma glucose (FPG) in cases and controls**

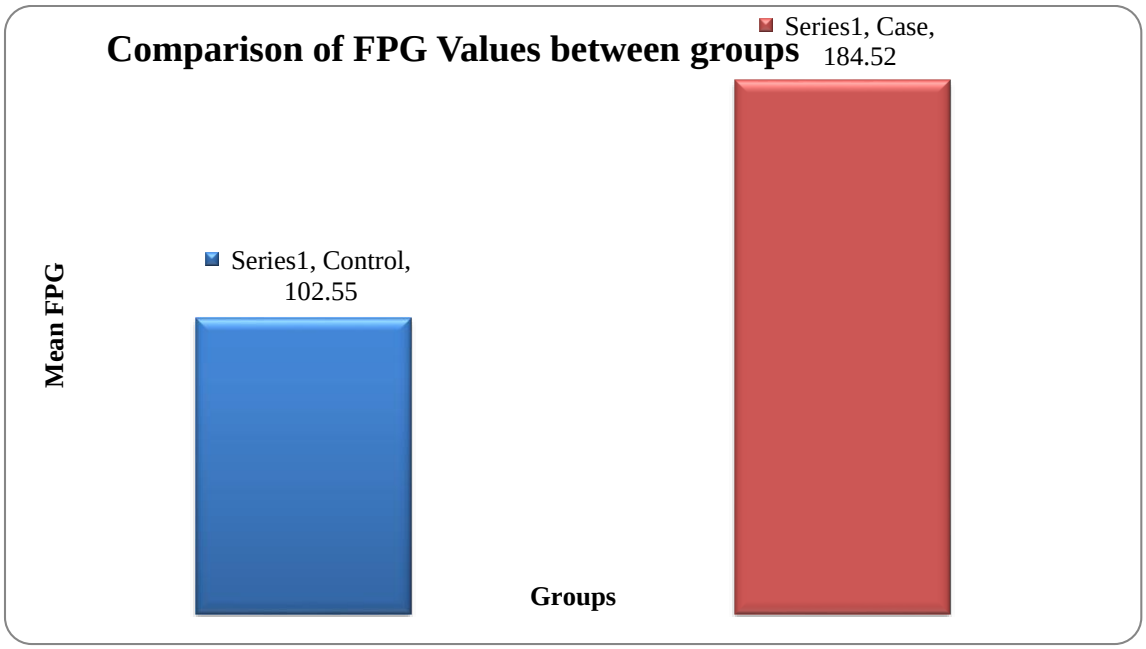



**Table-2: Mean distribution of HbA1C in cases and controls**

| Groups | N | HbA1C | | p Value |
|---|---|---|---|---|
| | | Mean | SD | |
| Control | 69 | 5.58 | 0.28 | <0.001 |
| Case | 69 | 8.75 | 1.67 | |

Mean HbA1C was found to be significantly high in cases than controls.

**Fig: 2 Graph showing the mean distribution of HbA1C in cases and controls**

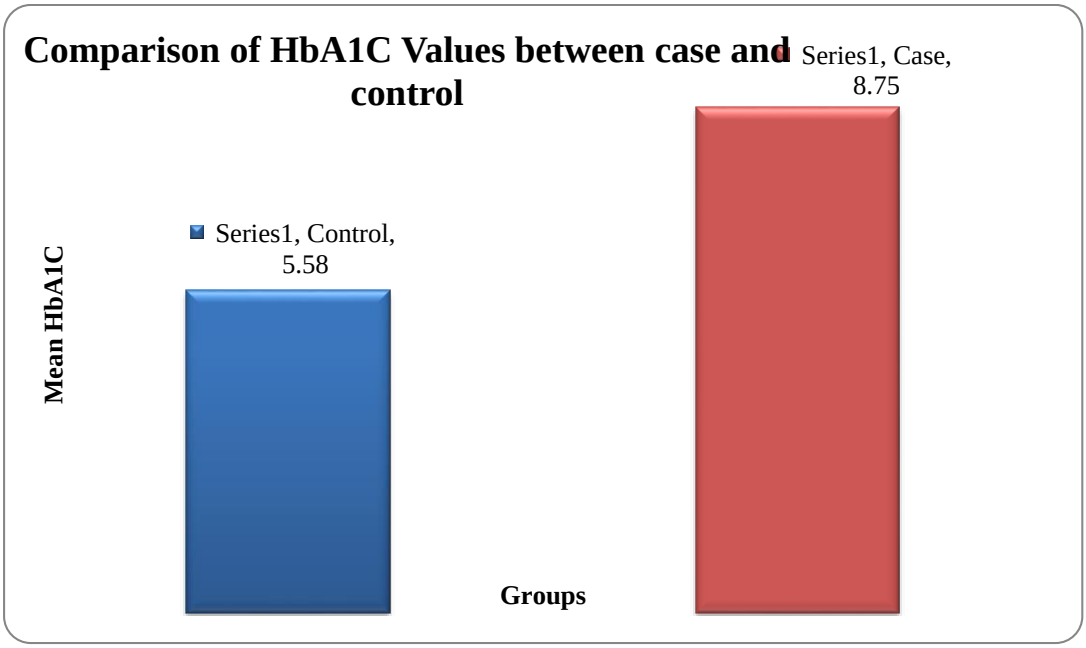
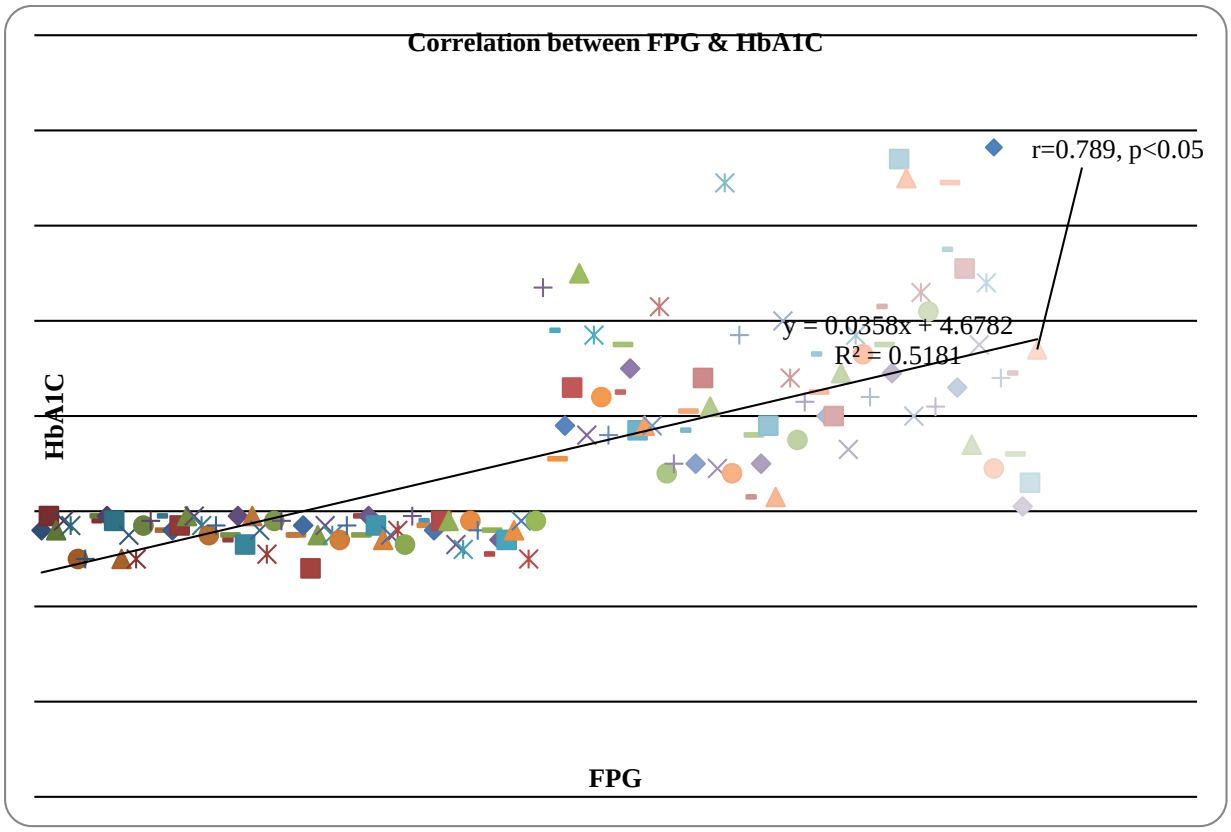



**Table-3 Correlation between FPG and HbA1C**

| Variable | FPG | | |
|---|---|---|---|
| | N | Pearson Correlation | p Value |
| HbA1c ( % ) | 138 | 0.790 | <0.001 |

Significant correlation was found between HbA1C and FPG

**Fig: 3 Scatter plot showing the correlation between FPG and HbA1C**




## VII. DISCUSSION

Type II Diabetes Mellitus is a metabolic disorder characterized by chronic hyperglycemia resulting from defects in secretion of insulin its action or both. It is also associated with significant microvascular and macrovascular complications.

In 1980 about108 million people were estimated to be affected by diabetes and in 2014 it has peaked to about 422 million. It was observed that in 2012 about 1.5 million deaths were caused due to the complications associated with diabetes.

India holds the dubious distinction termed the “diabetes capital of the world” as the largest number of diabetic subjects are present in India. According to the Diabetes Atlas 2006 published by the International Diabetes Federation, the number of people with diabetes in India is currently around 40.9 million and is expected to rise to 69.9 million by 2025 unless urgent preventive steps are taken. The so-called “Asian Indian Phenotype” refers to certain unique clinical and biochemical abnormalities in Indians which include increased insulin resistance, greater abdominal adiposity i.e. higher waist circumference despite lower body mass index, lower adiponectin and higher high sensitive C-reactive protein levels. This phenotype makes Asian Indians more prone to diabetes and premature coronary artery disease. (46) .

Hence diagnosing diabetes, predicting and preventing complication accurately is of paramount importance in Indian context considering the high prevalence of both the disease and its complications.

The universally accepted biochemical test parameters for assessing glycemic status in Type II Diabetes mellitus is HbA1c and fasting plasma glucose values. HbA1c level is considered as a gold standard for long term glycemic control and the half life of HbA1c is approximately 34 days, which is a factor that favours the estimation being accepted widely.

Various clinical trials have proved that fasting plasma glucose concentration along with HbA1c is often used to monitor the progress of diabetic patients. These parameters alone were not sufficient for diagnosing hyperglycemia and are often used in combination. In addition, HbA1c was found to be useful in predicting the risk of chronic complications of Diabetes mellitus and Cardiovascular diseases.(38,39) HbA1c > 9% indicates dyslipidemia, so the dual role of HbA1c in the prediction of glycemic status and as a lipid profile indicator can be used to screen for high risk diabetic patients and providing them with lipid lowering drugs and preventing the chances of coronary heart diseases. Thus measurement of HbA1c and FPG levels provides a definitive means of diagnosis and prognosis of diabetes which lead to the current advances in healthcare delivery.(39)

Our study aimed for the estimation of fasting plasma glucose values and HbA1c in type 2 DM and also whether these parameters correlated with each other.

In our study we observed significantly high levels of FPG in cases when compared to controls ($p<0.001$). Hyperglycemia is one of the most important finding in DM; progression of which leads to the long term complications of this disease. As the condition progresses the individuals are at risk for developing specific complications like retinopathy, nephropathy, neuropathy and atherosclerosis and later on to gangrene, stroke or coronary artery disease. Chronic hyperglycemia leads to increased glycation

of HbA1C; the measurement of which is useful in the long term control of glucose. HbA1C levels predict the complications of DM which are said to be due to the formation of advanced glycation end products. In our study we obtained significantly ($p<0.001$) high HbA1C levels in cases when compared to controls.

Study done by Arthur et al, and Rosediani et al also found an increase in the fasting blood glucose and HbA1C in diabetic patients when compared to controls.

HbA1c levels are found to increase along with fasting plasma glucose levels because as the blood glucose levels increase the glycation of HbA1C also occurs simultaneously. In our study, a positive correlation was observed between levels of fasting glucose and HbA1c in diabetic patients ( $r=0.790, p<0.05$).

Our findings go in hand with those of Asmita P et al where a significant positive correlation was found between FBS and HbA1C in diabetics. Similar findings were also seen in studies done by Arye L. V et al and Rahman M.A et al.(32,33) Studies have shown that if FPG test is conducted individually without HbA1c, the results fail to explain the variance of fasting plasma glucose values. (47)

## VIII. Conclusion

This study, points towards the association between blood glucose and HbA1C. The diagnostic potential in diabetes is enhanced when both HbA1C and FPG are used in combination. And hence this strategy is useful in assessing the status and therapeutic progress of diabetes mellitus. HbA1c and FPG correlate well and its utility is widened from diagnosis to prognosis of Type II Diabetes mellitus. Both of these parameters when used in combination is highly precise than when used individually.

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