MEDICAL CHANNEL

Original Article

ASSESSMENT OF FASTING AND TWO-HOUR POST-PRANDIAL GLUCOSE AS AN ECONOMICAL TEST FOR MONITORING OF GLYCEMIC CONTROL, COMPARED TO GLYCATED HAEMO-GLOBIN

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ABSTRACT

Objectives: To find a correlation of fasting plasma glucose (FPG) and 2-hrs post-prandial glucose (PPG) with glycated haemoglobin (HbA1c), so that an economical test could be selected for the monitoring of glycemic control in diabetic patients.
Study design: Cross-sectional and descriptive.
Methods : This study was conducted in the department of Pathology, Army Medical College Rawalpindi, National University of Sciences and Technology Islamabad, Pakistan, from May 2010 to August 2010. Seventy one known diabetic patients were included in the study. Two blood samples were collected after an 8-12 hours fast from all the patients. One for the estimation of HbA1c by ion-exchange resin method and the other for the estimation of FPG. The patients were then advised to take their routine breakfast and two hours after breakfast, another blood sample was collected for the estimation of the PPG. The FPG and PPG were estimated by Glucose oxidase method. Quality control check was maintained during all the tests.
Results: Out of total 71 known diabetics included, 35% were females and 65% were males. There was a stronger correlation of HbA1c with PPG (r-value 0.436 and p-value= <0.001) as compared to its correlation with FPG (r-value=0.284 and p-value=0.016). On comparing both the genders, the correlation of HbA1c with PPG was better in males as compared to females.
***Conclusion*:** PPG has a stronger correlation with HbA1c as compared to the FPG so a strict monitoring and control of PPG can help the clinicians have an economical alternative test, compared to HbA1c for glycemic control of their uncomplicated diabetic patients.

***Key words* :** Glycated haemoglobin, 2-hrs post-prandial glucose, glycemic control.

INTRODUCTION

Diabetes mellitus is a syndrome resulting from relative or absolute insulin deficiency, which leads to gross defects in glucose, fat and protein metabolism [1]. The prevalence of diabetes is continuously increasing in developing countries being more than 10% in Pakistan [1]. It is an important endocrine cause of mortality and morbidity all over the world [2]. Controlling the mean plasma glucose levels helps in lowering the incidence of both microvascular and macrovascular complications associated with diabetes [2,3].
American Diabetes Association (ADA) has included HbA1c =6.5% as the fourth criterion for the diagnosis of diabetes in its 2010 document [4]. It is assumed to be better than the PPG and FPG because there is substantially less biologic variability (<2% day-to-day within person variability for HbA1c compared with 12–15% for fasting glucose) moreover there is no need for a patient preparation like fasting [3].
HbA1c is a good indicator of a patient's mean plasma glucose level over the previous 90 to 120 days [1,5,6]. FPG = 7.0 mmol/L and PPG =11.1 mmol/L are supposed to have a good predictive value in diabetes complications [7]. However, HbA1c, being the gold standard

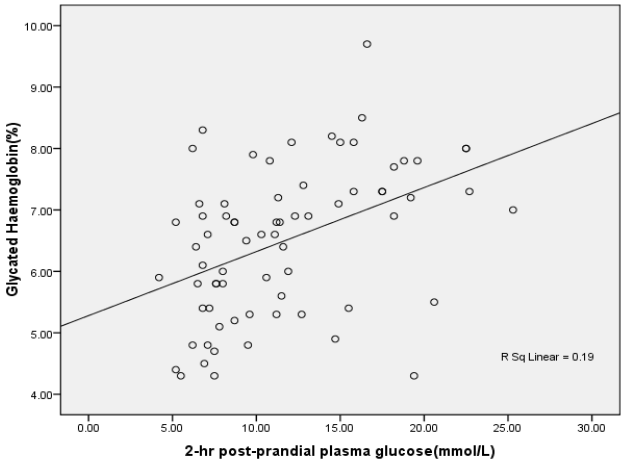


Fig -1 Scatter plot showing a direct correllation of Glycated haemoglobin (%) with 2 hhr post prandial plazma glucose level (mg/dl)

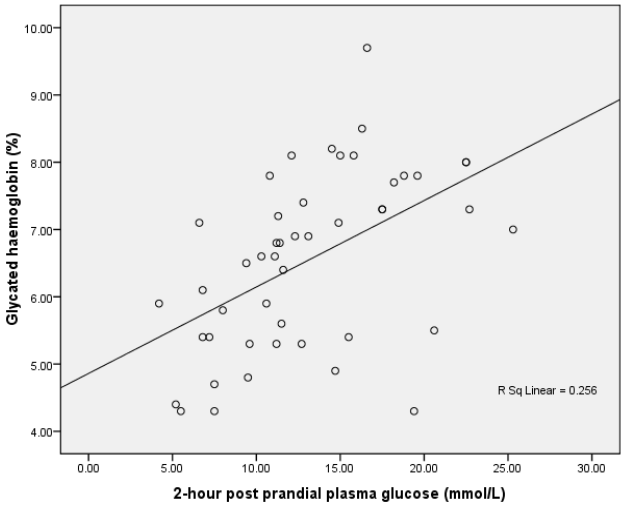


Fig -2 Scatter plot showing a direct correllation of Glycated haemoglobin (%) with fasting plazma gluucose levels (mg/dl)

Fig -2 Scatter plot showing correllation of Glycated haemoglobin (%) and 2- hrs Post-prandial Glucose levels (mg/dl) in female patients

for the estimation of glycemic control is supposed to be a better indicator of the diabetic complications [8]. A reduction of 1% of HbA1c could prevent 30-35% of microvascular and 14-16% of macrovascular complications [2].

Monitoring of the glycemic control by the FPG has a limitation of patient preparation like fasting for at least 8-12 hrs and HbA1c is relatively more expensive as compared to the FPG and PPG. The aim of this study was to find a correlation of FPG and PPG with HbA1c so that an economical test could be selected for day to day monitoring of glycemic control.

PATIENTS AND METHODS

This cross sectional descriptive study was conducted in the department of Pathology, Army Medical College, National University of Sciences and Technology, Rawalpindi, from May 2010 to August 2010. Seventy one known diabetic patients were included in the study.

After 8-12 hours fast, two blood samples were drawn from all the patients. One in the Potassium EDTA containing vial for the estimation of glycated haemoglobin and the other for the estimation of fasting plasma glucose level in fluoride oxalate vial. The patients were then advised to take breakfast and two hours after breakfast, another blood

Table-1:
Comparison of HbA1c and Plasma glucose levels in terms of technical skill, quality control and throughput.

Parameters	**HbA1c**	**Plasma glucose**
Sample	Whole blood	Plasma
Sample storage	Destroyed if frozen	Can be frozen for months below -20^{o}C
No. of steps	Five	Single
Technical skill required	More	Less
Quality control	More chances of random error	Less chances of random error
Time per test	more	less

sample was collected for the estimation of the post-prandial plasma glucose level.

HbA1c was estimated by ion-exchange resin method, following the steps of red blood cells lysis, HbA1c extraction by resin separator and then spectrophotometric estimation of absorbance of the HbA1c and HbA on Microlab 200. Percentage of HbA1c in total HbA was then calculated. Plasma glucose was determined by Glucose oxidase method on selectra-E. Quality control was maintained during both the tests.

Results were analyzed using the statistical package for the social sciences (SPSS) version-17. Pearson correlation coefficient(r) was calculated for the correlation of HbA1c with PPG and FPG and p-value of <0.05 was considered statistically significant.

RESULTS

Out of a total seventy one subjects, 25(35%) were females and 46(65%) were males. The mean age of the patients included was 51.8±13.4 yrs. The average value of HbA1c was 6.5±1.2% while of FPG and PPG were 7.1±2.5 mmol/L and 11.7±5.1mmol/L respectively.

We found a stronger correlation of HbA1c with PPG (r-value 0.436 and p-value= <0.001) as compared to FPG (r-value=0.284 and p-value=0.016) as shown in Fig. 1. On comparing the correlation of HbA1c with PPG between the two genders, the correlation was more significant in males as compared to the females (r-value=0.506 vs 0.225 and p-value <0.001 vs 0.280) as demonstrated in Fig. 2.

Comparing the HbA1c with plasma glucose level estimation, HbA1c is more expensive, with more chances of random error requiring highly specialized technical skill and has a lower throughput as compared to plasma glucose estimation as shown in table-1

DISCUSSION

The ever increasing prevalence of diabetes along with associated high mortality and morbidity is a matter of great concern worldwide. Strict glycemic control can help in preventing the complications associated with it. The close monitoring of contributions of FPG and PPG to overall HbA1c is essential so that the most appropriate and effective treatment regimen designed by appropriate titration, may be implemented [5]. In our study, we found a better correlation of HbA1c with PPG as compared to FPG

Our results are similar to many. studies conducted in various parts of the world. In a study conducted by Haddadinezhad et al, in Iran, the HbA1c was found to have a better correlation with 2 hr PPG as compared to the FPG (r-value 0.416 vs 0.312) [2]. In another study conducted by Rosediani et al, both PPG and FPG significantly correlated with HbA1c but PPG showed a better correlation with HbA1c as compared to FPG (r= 0.604 vs.0.575) [9]. In Thailand, Soonthorpun et al, in a study conducted on 35 type-2 diabetic patients, the 2-hr PPG concentrations were found to correlate more strongly (r=0.51) with HbA1c levels than 1-hr PPG (r=0.35) and FPG (r=0.46) concentrations [8]. Fonseca in his study in New Orleans found that PPG which is directly associated with cardiovascular complications, is important to overall glycemic control and may be a better index of glucose regulation than FPG in diabetics [10]. Riet et al, in their study found that the correlations of HbA1c with FPG and PPG were 0.71 and 0.79 [11].

The results of our study do not match with the study conducted by Mac Can et al who found that the determination of HbA1c or FPG concentrations alone may be acceptable alternatives to measuring glucose concentration two hours after a glucose load for the diagnosis of diabetes [12]. Similarly, in another study, on patients with non-insulin-treated type 2 diabetes, Bonora et al showed that HbA1c levels are more closely related to preprandial than to postprandial glucose levels [13]. In our study, we found that the correlation of HbA1c was stronger to the PPG as compared to the FPG. So complications resulting from a poor glycemic control can be prevented by keeping the PPG levels under control.

CONCLUSION

The glycated haemoglobin has a better correlation with the PPG as compared to its association with FPG. So we conclude that the two hour post-prandial plasma glucose level is a simple, feasible and economical alternative for monitoring glycemic control, compared to HbA1c in uncomplicated diabetic patients.

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