Correlation of Fasting and Post Prandial Plasma Glucose with Hemoglobin Glycation

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ABSTRACT

Association of fasting plasma glucose (FPG) and post prandial plasma glucose (PPG) on hemoglobin glycation is still controversial. In this study we aimed to assess the influence of FPG and PPG on hemoglobin glycation in newly diagnosed never treated diabetic (NDNT-DM) subjects and treated diabetic (T-DM) subjects. One hundred and seventy seven diabetic subjects were included in this study. Plasma glucose concentrations were measured by hexokinase end point technique and glycated hemoglobin (HbA1c) levels were measured by modified cation-exchange high performance liquid chromatography (HPLC). Univariate and multivariate linear regression models were applied to assess the relative contribution of FPG and PPG on HbA1c. Univariate linear regression analysis showed significant positive association of FPG and PPG with HbA1c in both groups. Multivariate regression model showed that ? (beta) value of HbA1c was 0.5528 (p<0.0001) for FPG and 0.3047 (p<0.01) for PPG in the NDNT-DM whereas 0.5509 (p<0.0001) for FPG and 0.1874 (p>0.05) for PPG in treated diabetic subjects. After adjustment for age and sex, beta remains statistically significant for FPG and PPG where beta value for FPG was higher for FPG than for PPG in both NDNT-1M group and T-DM groups. This study revealed that FPG has a stronger association on hemoglobin glycation as compared to PPG in diabetes mellitus.

Key words: Fasting plasma glucose, Post prandial plasma glucose, HbA1c

Introduction

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by rise in blood glucose level and derangement in protein and fat metabolism1. The formation of advanced glycation end products (AGEs) plays an important role for the development and progression of the long term complications of DM2. Glycated hemoglobin A (HbA1c) is the well characterized amadori product, produced in the early stage of AGE formation and the role of HbA1c in the management of DM is well established3-5. Measurement of HbA1c is an important component for the management of patients with diabetes mellitus, i.e., to monitor
Results

The mean ± SD of age of the total study subjects was 48.4 ± 12.3 years. Of the total 55.9% were males and 44.1% were females. Among them 57.06% were newly diagnosed never treated diabetic subjects and 42.94% were diabetic who used anti-hyperglycemic agents for the management of DM during the last three months. Characteristics of the study subjects are presented in Table I.

Table I: Characteristics of the study subjects

<table>
<thead>
<tr>
<th>Parameters</th>
<th>NDNT-DM (n=101)</th>
<th>T-DM (n=76)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>46 ± 12</td>
<td>52 ± 11</td>
</tr>
<tr>
<td>Sex (M/F)</td>
<td>59/42</td>
<td>40/36</td>
</tr>
<tr>
<td>FBG (mmol/L)</td>
<td>8.9 ± 3.3</td>
<td>8.8 ± 4.1</td>
</tr>
<tr>
<td>PPG (mmol/L)</td>
<td>16.0 ± 4.3</td>
<td>11.9 ± 5.0</td>
</tr>
<tr>
<td>HbA1c (%)</td>
<td>9.2 ± 2.5</td>
<td>9.3 ± 2.5</td>
</tr>
</tbody>
</table>

Multivariate linear regression analyses showed that the β (beta) value of HbA1c was 0.5528 (p<0.0001) for FPG and 0.3047 (p<0.01) in the NDNT-DM group; 0.5509 (p<0.0001) for FPG and 0.1874 (p>0.05) in the T-DM group. After adjustment for age and sex, β remains statistically significant for FPG and PPG in both NDNT-TM and T-DM group (Table II).

Discussion

In this study, we examined the relative contribution of fasting plasma glucose levels and post prandial plasma glucose levels on hemoglobin glycation in the newly diagnosed never treated diabetic subjects and treated diabetic subjects. Both univariate and multivariate linear regression analyses showed that the contribution of hemoglobin glycation is

Materials and Methods

One hundred and seventy seven specimens were collected from newly diagnosed never treated and treated confirmed diabetic subjects during January 2012 to June 2012. Fasting and post prandial blood specimens were collected for the estimation of fasting plasma glucose, post prandial plasma glucose (2 hrs after 75g oral glucose load and 2 hrs after breakfast) and estimation of HbA1c. Plasma glucose levels were measured by hexokinase end point techniques using Dimension RXL max automated analyzer (Siemens Healthcare Diagnostics Ltd.). HbA1c were measured by modified high-pressure liquid chromatography (HPLC) method using D-10™ glycosylated hemoglobin testing system (Bio-Rad Laboratories, Inc., Hercules, CA, 94547, USA). Results are expressed as mean ± SD. Univariate and multivariate linear regression models were applied to assess the relative strength of contribution of fasting or post prandial plasma glucose levels on hemoglobin glycation. Statistical analyses were performed by using STATISTICA version 8 for Windows.
higher for fasting plasma glucose levels than post prandial plasma glucose levels in both never treated and treated diabetic subjects. After adjustment for age and sex, the association between plasma glucose and HbA1c remains statistically significant for FPG and PPG in both groups and contribution of fasting plasma glucose on hemoglobin glycation remains higher than the contribution of post prandial plasma glucose in both groups (Table II).

In this study, the relationship between fasting plasma glucose and HbA1c is closer to DCCT\(^{11}\) (~0.81 vs 0.82). The correlation coefficient between fasting plasma glucose and HbA1c was higher than the correlation coefficient between post prandial plasma glucose and HbA1c in control in the study population of Masram et al\(^{13}\) (0.733 vs 0.699) whereas in type 2 diabetic subjects the relationship was found to be reversed (0.588 vs 0.776)\(^{13}\). Azim et al\(^{14}\) also found modest relationship of FPG (r = 0.284) and PPG (r = 0.436) with HbA1c and here PPG contributed higher in the glycation of hemoglobin. Another research group found that FPG levels showed better correlations with HbA1c than with PPG levels in non-diabetic, pre-diabetic and newly diagnosed never treated diabetic subjects\(^{12}\). We observed similar trend of relationship between FPG and HbA1c, PPG and HbA1c in both never treated and treated diabetic subjects. Hossain et al\(^{15}\) considered non-diabetic, newly diagnosed pre-diabetic and diabetic subjects and showed that FPG contributed higher than PPG in the glycation of hemoglobin. So the finding of this study is in concordance with the previous study done in Bangladeshi population\(^{12,15}\) but inconsistent with the findings of studies done in abroad.\(^{13,14}\)

Therefore, measurement of fasting plasma glucose along with HbA1c may provide better outcome in the management of diabetic complications.

**Conclusion**

The contribution of fasting plasma glucose on hemoglobin glycation is higher than the contribution of post prandial plasma glucose levels in both newly diagnosed never treated and treated diabetic subjects.

**References**

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