Pyrex Journals 2035-8994

Pyrex Journal of Biomedical Research
Vol 1 (1) pp. 007-010 June, 2015
http://www.pyrexjournals.org/pjbr

Original Research Article

Role of HBA_1C in Diagnosis of Diabetes Mellitus

NH Abdalrahman[1], GA Modawe[2] and AA Abdrabo[1*]

[1]Department of clinical chemistry, Faculty of medical laboratory Sciences, Alneelain University, Khartoum, Sudan
[2] Department of Biochemistry, Faculty of Medicine, Omdurman Islamic University, Omdurman, Sudan

Accepted 12th June, 2015

Background: HbA_1C is now formally endorsed in many countries as a diagnostic test for (type 2) diabetes as well as for monitoring, although some debate still continues regarding it is applied for diagnosis.
Objective of the Study: The study aimed to measure, HBA_1C, FBG and urine chemistry in new diabetic patients.
Material and Methods: A case control study was conducted on 50 newly diagnosed type 2 diabetes mellitus patients and the control groups consisted of 50 healthy in Sharig-Elneel Province during January to April 2015. Their HbA_1c and fasting blood sugar (FBG) was tested. The association between HbA1c and FBG and also their sensitivity, specificity and predictive values in the detection of abnormal values of each other were determined. Analysis of biochemical parameters was performed by Cobas c111. Fasting blood sugar and HbA_1c also compared according to age and BMI in diabetic patients. Statistical analysis was done by student-t–test in addition to chi-square. The P value < 0.05 was considered as significant.
Results: The study was conducted on 50 newly diagnosed type 2 diabetes mellitus patients with mean age 44.70 ±12.1 years and the control groups consisted of 50 healthy individuals with mean age 35. 5±12.7 years. The mean age of patients was significantly higher in type 2 diabetic patients compared to controls (p< 0.05). BMI was statistically significant increased in type 2 diabetic patients (27.8±4.9) kg/m2 weight compared to (24.6±3.8) kg/m2 weight in control subjects. Blood sugars FBG mg/dl (205.1±89.3) and Hba_1c% mg/dl (10.3±2.5) was significantly higher in type 2 diabetes mellitus patients as compared to control group FBG mg/dl (89.6±10.3) and Hba_1c% mg/dl (5.7±.5) p<0.05.
With a cut-off value for the diagnosis of DM of 6.5%, HbA_1c had a sensitivity of 89.2% and a specificity of 100%, with positive and negative predictive values of 100% and 86%, respectively.
Conclusion: Glycated hemoglobin may be a useful measure for diagnosing diabetes and supports a possible cut-off point ≥6.5% that is in line with current recommendations.

Key words: HBA_1C, Diagnosis, Diabetes mellitus.

INTRODUCTION

Diabetes mellitus is one of the most prevalent non communicable diseases and has become a modern epidemic. [1] Globally, it is among the top ten leading causes of death in most high-income countries, and there is a substantial evidence for it being an epidemic in many developing countries. Patients with diabetes mellitus are at higher risk to develop both micro vascular and macro vascular complication. [2] Although, it is one of the most extensively investigated human diseases, it often remains under diagnosed. [3] Moreover, the Asian Indian phenotype is more prone to diabetes mellitus than the rest of the world's population, and most of the people with diabetes are between 40 and 59 years of age. [4,5] Haemoglobin A1c (HbA_1c) has been the mainstay in the determination of glycaemic control in the management of diabetes mellitus (DM) for 30 years, and has been used in many clinical long-term studies [6,7].

It would be near impossible to discuss the evaluation of glycaemic control in DM without referring to glycated hemoglobin (HbA1c). At the present time, HbA1c is the most commonly measured method of assessing chronic glycaemia in clinical practice [8]. It has been used as a surrogate marker of long term glycaemic control in patients with DM for more than 30 years, both in clinical practice and in countless studies and trials [9]. However Diabetes mellitus (DM) is one of the most commonly encountered chronic disorders. By 2030, the worldwide prevalence of adult DM is expected to rise to 7.7%, which roughly translates to 439,000,000 affected individuals [10]. Based on current recommendations, a diagnosis of DM requires the presence of a fasting plasma glucose concentration of ≥126 mg/dL, or a 2-h plasma glucose level of ≥200 mg/dL on an oral glucose tolerance test (OGTT). On the other hand, international committee members selected by the

Corresponding Author: abdrabokarim@hotmail.com

American Diabetes Association (ADA) and the Alliance for European Diabetes Research (EURADIA) recently suggested that glycosylated hemoglobin (HbA_1c) could be used as an alternative for making a diagnosis. [11] The committee concluded that an HbA_1c level of ≥6.5% was diagnostic for DM, without requiring a determination of blood/plasma glucose levels. However, the use of standard glucose measurements is still recommended for individuals when HbA1c assays are deemed unreliable [12] HbA_1c is formed as a result of the addition of a stable glucose molecule to the N-terminal group of an HbA0 molecule via a non enzymatic glycation process [13], and is considered a reliable indicator of the glycemic status of the previous 3 months [14]. Van't Riet et al. [15] reported on a significant, albeit moderate, the correlation between HbA1c and fasting plasma glucose (r=0.57) and 2-h plasma glucose (r=0.35) levels. It was suggested that as well as the neglecting of several cofactors such as age, sex, and ethnic characteristics [16]. The study aimed to measure HBA_1C, FBG and urine chemistry in new diabetic patients.

Material and Methods

Study Population

The study is case control study hospital based conducted in Sharg-Elneel Province in the period from January to April 2015.The study included 50 new diabetic and 50 healthy individuals.

Exclusion Criteria

Known diabetic's patients, haemoglobinopathies (depending on the assay employed), certain anemias, and disorders associated with accelerated red cell turnover such as malaria.

Blood Sampling

For each patient, blood samples were obtained at 0800 hours following a 12-h fast, from the antecubital vein in a sitting position, for the determination of HbA_1cas well as a baseline/fasting blood glucose level. HbA_1c and FBG measurements were made using Cobas c111. An HbA_1c of 6.5% is recommended as the cut point for diagnosing diabetes. A value of less than 6.5% does not exclude diabetes diagnosed using glucose tests. The role of HbA_1c in the diagnosis of diabetes recommended that HbA_1c can be used to diagnose diabetes and that the diagnosis and be made if the HbA_1c level is ≥6.5 % [17]. Diagnosis should be confirmed with a repeat HbA_1c test, unless clinical symptoms and plasma glucose levels >11.1mmol/l (200 mg/dl) are present in which case further testing is not required. Levels of HbA_1c just below 6.5% may indicate the presence of intermediate hyperglycemia. [19]. In order to detect diabetes, fasting blood glucose (FBS) is suggested as the best and the most common test with the cutoff point >126mg/dl. [20]

Ethical Considerations

The study was approved by Alneelain University. Informed consent was obtained from all study participants.

Data Analysis

The data were evaluated by SPSS statistical package version 18.0. Descriptive analysis means, one sample t-test will be used. Cross tabulation and correlation were used where appropriate. Value of HbA_1c will be given as a percentage of total hemoglobin and values of all other parameters will be given in mg/dl. P value < 0.05 was considered as significant.

Discussion

The results of the study were shown in table 1, 2 and figure 1. The study was conducted on 50 newly diagnosed type 2 diabetes mellitus patients with mean age 44.70 ±12.1 years and the control groups consisted of 50 healthy individuals with mean age 35. 5 ±12.7 years. The mean age of patients was significantly higher in type 2 diabetic patients compared to control ($p< 0.05$). This finding indicated that control subjects were younger compared to patients. The result in line with Roshan et al [21].Statistically significant increased in type 2 diabetic patients (27.8±4.9) kg/m2 weight compared to (24.6±3.8) kg/m2 weight in control subjects. However, another study proved that Diabetes increased progressively with the increase in BMI [22]. Moreover the result is in accordance with the study of ELHazmi et al [23], Naheed and Akbar N [24] and Sindelka et al [25]. The biochemical parameters in type 2 diabetes mellitus patients and control subjects are reported in Table 1. Blood sugars FBG mg/dl (205.1±89.3) and Hba1c% mg/dl (10.3±2.5) was significantly higher in type 2 diabetes mellitus patients as compared to control group FBG mg/dl (89.6±10.3) and Hba_1c% mg/dl (5.7±.5) $p<0.05$. Similarly FBG and HbA_1c were also found to be significantly higher in patients as compared to control. These findings were in agreement with the previous studies by Wexler et al [26].The study results found an HbA_1c threshold of 6.5% highly valuable for detecting diagnosed diabetes, which demonstrated sensitivity and specificity of 89.2% and 100%, respectively with 100% positive predictive value and 86% negative predictive value. The findings contrasted with many studies in East Asia countries showed an optimal HbA_1c cutoff for diagnosing diabetes of 5.6%in Japan 16 and 5.9% in Korea.[27] In a Middle Eastern population, researchers found an HbA_1c threshold of 6.4%. [28] Therefore, HbA_1c criteria for diagnosing diabetes in different populations are needed. However the result was supported by American Diabetes Associationin screening newly diagnosed diabetes by the HbA_1c threshold of 6.5%, we found a sensitivity of 63.9% and a specificity of 92.8%. [29]

Conclusion

HbA_1c levels can be used with regular checkups of FBG and HbA_1c levels in diabetic patients. However an HbA_1c threshold of 6.5% was highly valuable for diagnosing newly diagnosed diabetes.

Results

Table 1: Demographic characteristics and laboratory findings of study population

Variable	Patient n =50 (mean± SD)*	Control n =50 (mean± SD)*	P-value
Age/Year	44.7±12.1	35.5±12.7	.000***
BMI	27.8±4.9	24.6±3.8	.000***
FBG/mg/dl	205.1±89.3	89.6±10.3	.000***
HbA_1c%	10.3±2.5	5.7±.5	.000***

***P-value considered significant at 0.05 level

*Values provided as mean ± standard deviation; BMI, body mass index; HbA1c, glycosylated hemoglobin; FBG, Fast Blood Gulcose.

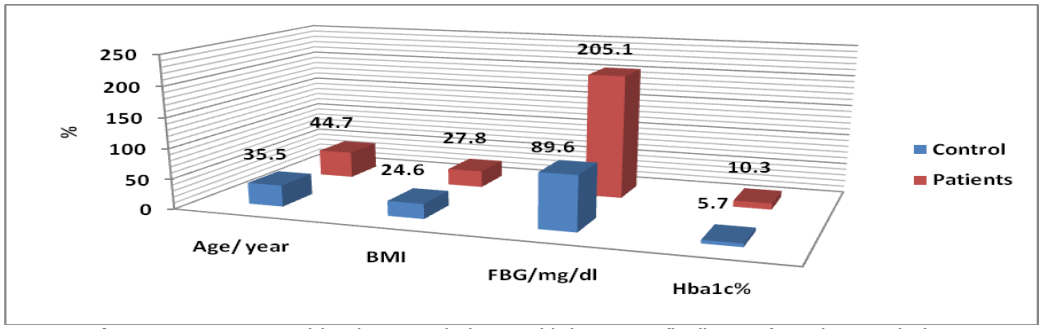

Figure 1: Demographic characteristics and laboratory findings of study population

Table 2: Sensitivity, Specificity, Positive Predictive Value, and Negative Predictive Value for Detecting Newly Diagnosed Diabetes and at cutoff point Hemoglobin A1c threshold

Newly diagnosed diabetes				
HbA1clevel (%)	Sensitivity	Specificity	PositivePredictivevalue	Negativepredictive Value
6.5	89.2%	100%	100%	86%

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