The Professional Medical Journal
www.theprofesional.com

DOI: 10.29309/TPMJ/18.4263

ORIGINAL PROF-4263

DIABETES;

COMPARISON OF HBA1C AND SERUM GLYCATED ALBUMIN LEVELS AS MONITORING TOOL

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Article received on:
19/08/2017
Accepted for publication:
10/11/2017
Received after proof reading:
02/01/2018

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ABSTRACT… Introduction: Diabetes is one of the most common non-communicable diseases globally. Number of methods has been proposed for early detection and monitoring of diabetes. Glycated hemoglobin (HbA1c) is one of the indices used for long-term hyperglycemic control. Recently another method used for evaluation of hyperglycemia is measurement of glycated albumin (GA). The purpose of this study was to compare HbA1c and serum GA levels in diabetic patients in Peshawar. **Settings: Study Design:** Prospective cross sectional study. **Period:** July to August 2014. **Setting:** Teaching Hospitals of Peshawar Medical College (Mercy and Kuwait Teaching Hospitals). **Material and Methods:** This study consisted of whole blood samples of 47 diabetic individuals. GA estimation was done by Enzyme-Linked Immuno-Sorbent Assay (ELISA) whereas HbA1c estimation was performed by Fast Ion-exchange Resin Separation Method. **Results:** The mean age of diabetics was 55 ± 10.3 years. According to HbA1c levels, 25.5% subjects had good glycemic control and 74.5% subjects had poor glycemic control. While the GA estimation showed 42.6% patients having glycemic levels within normal range and 57.4% subjects had uncontrolled glycemia. **Conclusions:** According to this study, GA is a marker of medium term glycemic control which can be considered to include in routine workup of diabetes mellitus management.

Key words: Diabetes Mellitus, HbA1c, Glycated Albumin.

Article Citation: Gul A, Sharif N, Zahoorullah, Ahmed S. Diabetes; comparison of hba1c and serum glycated albumin levels as monitoring tool. Professional Med J 2018;25(1):109-114. **DOI:**10.29309/TPMJ/18.4263

INTRODUCTION

Diabetes is one of the most common non-communicable diseases globally[1] and a great challenging health problem in the 21st century.[2] It is being labeled as the fourth or fifth leading cause of death in most high-income countries. According to WHO by the year 2000 its number was 171 million and it will rise to 366 million by the year 2030.[2] Large number of studies has confirmed that low and middle-income countries face the greatest burden of diabetes.[2]

Pakistan has about 5.2 million affected people in 2000, with projected estimates expected to 13million by 2030.[3]

Diabetes is a chronic disease which needs continuing care to avoid complications. These complications include coronary heart disease, cerebrovascular disease, retinopathy, nephropathy, and neuropathy. These complications are a key cause of morbidity and mortality.[4] Good glycemic control in patients with diabetes decreases the incidence of diabetic complications.[5] Globally there is shift toward an older population, therefore number of adults over the age of 65 years living with diabetes increased dramatically.[6]

Number of methods has been proposed for early detection and control of diabetes. The glycated hemoglobin (HbA1c) is one of the indices used for long term (3-4 months)[7,8] hyperglycemic control in majority of diabetic patients. The risk of diabetic complication are directly related to levels of HbA1c.[7] In June 2009, an International Expert Committee with members appointed by the American Diabetes Association (ADA), the European Association for the Study of Diabetes (EASD) and the International Diabetes Federation (IDF) advocated the use of glycated hemoglobin (HbA1c) as a primary diagnostic tool for diabetes

and these recommendations are based on several clinical trials.[8] The cut-off point of 6.5% HbA1c should be used for the diagnosis of diabetes where as 5.7% or more is screening criteria for diabetes.[9] Due to longer life span of RBC (120 days), HbA1c may not be appropriate tool for investing short-term glycemic control. Furthermore, the life span of RBC is affected by factors such as anemia and chronic diseases which may consequently result in artefactual levels of HbA1c.[10-12]
Recently serum GA has been considered as an alternative investigating tool for glycemic control in patients with diabetes because of short half life of serum albumin i.e.15 to 20 days.[13,14]

Though no study has been carried out in Pakistan for estimation of GA in diabetic patients therefore, the present study was designed to compare HbA1c and serum GA levels in diabetic population of Peshawar.

MATERIAL AND METHODS

This prospective cross sectional study consisted of whole blood samples of 47 diabetic individuals presented at attached teaching hospitals of Peshawar Medical College (Mercy and Kuwait Teaching Hospitals). After the full explanation of the study, written informed consent was obtained from each study subject. The ethical committee of the institution approved the study. Only those patients were included who were confirmed type II diabetes with age more than 40 years. Anemic patient and those with history of renal and hepatic diseases were excluded.

The data were collected on a specially designed performa, which contained demographic and anthropometric details like age, weight, height and duration of diabetes. Body Mass Index (BMI) (kg/m2) was calculated using the standard formula.

The diagnosis of diabetes was based on previous history of diabetes and levels of fasting blood sugar in the patients.

Blood samples were collected for the biochemical estimations of glycated hemoglobin and GA levels of patients.

GA estimation was done by using kit Glycaben of Exocell through enzyme-linked immune-sorbent assay (ELISA). HbA1c estimation was done by using kit Human of Diagnostic worldwide through Fast Ion-exchange Resin Separation Method.

In case of glycated hemoglobin, diabetic patients with value below 7% were labelled as controlled and 7% or above were categorized as uncontrolled. (Human Gesellschaft fur Biochemica und Diagnostica GmbH, Max-Planck-Ring 21 – D-65205 Wiesbaden – Germany) Similarly, regarding GA the serum value below 1.4 for diabetic patients were considered as controlled and equal or above 1.4 as uncontrolled as per instructions of manufacturer (Glycaben; Exocell).

Data were analyzed statistically. For descriptive analysis means and standard deviation were calculated for numerical variables and proportions for all the categorical variables in the study. P values were determined using chi square tests for the comparison of proportion and fisher exact test[15] where any value was below 5. Probability value (P value) of less than 0.05 was taken as statistically significant.

RESULTS

Forty seven subjects who fulfilled the inclusion criteria participated in this study. The inclusion criteria were previously diagnosed diabetic patients either male or female having age more than 40 years. Consecutive sampling technique was used. Among them 25 (53%) were female while 22 (42%) were males. The mean age of the subjects was 55 ± 10.3 years. The patients were categorized into age group below 60 and equal or above 60. The HbA1c and GA levels were estimated in both the age groups.

In case of age less than 60 years, among diabetics 9 had good levels of HbA1c and 19 had poorly controlled levels. Among subjects equal to or greater than 60 years of age 3 diabetics had good control and 16 were categorized as poorly controlled. P value for subjects both less than 60 and greater than or equal to 60 years was non-significant.

Similarly subjects were divided into two categories for GA by taking a cutoff point of 1.4%. In subjects under 60 years age among cases 13 had good levels of GA and 16 had uncontrolled GA levels. In subjects greater than or equal to 60 years of age, among cases 8 had controlled levels and 10 were categorized as uncontrolled. P value for subjects both less than 60 and greater than or equal to 60 years was non-significant.

While estimating the levels of GA, there is almost equal distribution of diabetic patients in both categories of controlled and uncontrolled cases with reference to their age, gender and BMI sub groups. Table-I However, regarding HbA1c estimation most of the diabetic patients were found as having uncontrolled diabetes in different age groups, among male and female cases and in BMI subgroups. Table-II

Out of 47 cases, 9 diabetic cases were found controlled by both GA and HbA1c while 24 cases were detected as uncontrolled by both indices. Table-III.

DISCUSSION

Diabetes is one of the common non-communicable diseases and different measures have been proposed for early detection and control of diabetes. The glycated hemoglobin (HbA1c) is used for long term (3-4 months)[8] hyperglycemic control and GA used for medium term glycemic

Characteristics of Diabetic Patients		Glycated albumin		P value
		Controlled *(<1.4%)	Uncontrolled *(≥1.4%)	
Age	Under 60	13(44.8%)	16(55.1%)	*0.561
	60 and above	8(44.4%)	10(55.5%)	
Gender	Male(22)	10(45.4%)	12(54.5%)	*0.773
	Female(25)	11(44%)	14(56%)	
BMI	Underweight(<18.50)	2(50%)	2(50%)	**0.943
	Normal(18.50-24.99)	8(42.1%)	11(57.8%)	
	Overweight(≥25.00)	6(42.8%)	8(57.1%)	
	Obese(≥30.00)	5(50%)	5(50%)	

Table-I. Comparison of demographic detail of patients with reference to Glycated Albumin
***chi square test, **Fischer's exact test**

Characteristics of Diabetic Patients		HbA1c		P value
		Controlled *(≤7%)	Uncontrolled *(>7%)	
Age	Under 60	9(32.1%)	19(67.8%)	*0.310
	60 and above	3(15.7%)	16(84.2%)	
Gender	Male(22)	5(22.7%)	17(77.2%)	**0.505
	Female(25)	3(12%)	22(88%)	
BMI	Underweight(<18.50)	1(33.3%)	2(66.6%)	**0.650
	Normal(18.50-24.99)	4(20%)	16(80%)	
	Overweight(≥25.00)	3(21.4%)	11(78.5%)	
	Obese(≥30.00)	4(40%)	6(60%)	

Table-II. Comparison of demographic detail of patients with reference to HbA1c
***chi square test, **Fischer's exact test**

		Glycated Albumin		p-value
		Controlled	Uncontrolled	
HbA1c	Controlled	9	3	**0.061
	Uncontrolled	11	24	

Table-III. Comparison of glycated albumin and hba1c in diabetic patients
****Fischer's exact test**

control (2-3 weeks).[16-19]

In this study, HbA1c and serum GA levels in diabetic population of Peshawar were compared regarding monitoring of hyperglycemia.

The present study conducted on 47 type II diabetics for their HbA1c and GA level has not been studied before in KPK.

Whole blood HbA1c showed that among diabetics 25.5%[12] subjects had good glycemic controls and 74.5%[35] had poor glycemic control. But when the GA levels of same subjects were assessed, among diabetics 42.6%[20] were having controlled levels whereas 57.4%[27] were having uncontrolled levels. So the present study suggests that GA is a marker of short term glycemic control. As many hospitalized patients shows controlled glycemic levels because of restricted diet and intensive treatment during their stay in hospital. GA levels might be reduced more rapidly as compared to HbA1c suggesting that GA is a short term glycemic marker. This is in accordance to the study conducted by Takahashi S et al of Tokyo (Japan).[20] The rapid decrease in GA noted in the present study reflects the faster turnover of plasma albumin than that of RBC.

Among diabetics with age less than 60 years, 32.1%[9] had good levels of HbA1c and 67.8%[19] had poorly controlled levels. The subjects with age 60 years or more having diabetes, 15.7%[3] had good control and 84.2%[16] were categorized as poorly controlled. These results clearly show that HbA1c levels increases with increase in age and this finding is in accordance with study by Pani et al.[21] Other studies also confirm the positive association between age and HbA1c in adults[22,23] and children.[24]

Although Wu et al[25] in their study found a positive association of GA with age but in our study the levels of GA did not showed any dissimilar percentage of between controlled and uncontrolled diabetic cases which were also statistically non significant which is probably due to small number of cases in our study.

In our study while assessing the HbA1c levels, no statistical difference was found between controlled and uncontrolled diabetic cases among male and female. These findings are partially in agreement for uncontrolled diabetic cases.[26]

Similarly, gender also did not show any effects on estimation of GA and found to be statistically insignificant. Our findings are consistent with data recorded by Yang C et al.[27]

Neither GA nor HbA1c showed any statistically significant difference between controlled and uncontrolled diabetic patient belonging to different BMI categories. Out findings are partially consistent with koga et al[28] who found only GA negative correlation with BMI.

While comparing the number of controlled and uncontrolled diabetic cases detected by GA and HbA1c, more than half of the cases were discrepant and found to be statistically significant. Table-IV Some studies supported our this observation.[29]

The GA detected more controlled diabetic cases as compared HbA1c among participants in our study. Reciprocally HbA1c succeeded in finding more uncontrolled diabetic cases in above mentioned participants (Figure-1 and Figure-2).

According to this study, GA is a marker of medium term glycemic control which can be considered to include in routine workup of diabetes mellitus management.

ACKNOWLEDGMENT

Dr. Ahmad Rafique, Associate Professor Khyber Medical College Peshawar and management of OK Diagnostic Laboratories University Town Peshawar are acknowledged for their technical assistance in the analysis.

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He who kneels before god
can stand before anymore.

– Unknown –

AUTHORSHIP AND CONTRIBUTION DECLARATION

Sr. #	Author-s Full Name	Contribution to the paper	Author=s Signature
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3	Zahoorullah	Revising of draft, Final approval of draft	
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