# **INDONESIAN JOURNAL OF** CLINICAL PATHOLOGY AND MEDICAL LABORATORY

Majalah Patologi Klinik Indonesia dan Laboratorium Medik

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# THE COMPARISON BETWEEN HBA1C AND GLYCATED ALBUMIN LEVELS IN PATIENTS WITH DIABETES MELLITUS TYPE II WITH OR WITHOUT CHRONIC KIDNEY DISEASE

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#### ABSTRACT

The most appropriate marker to assess the glucose level of diabetes mellitus patient with chronic kidney disease has not been recognized. The reduction of an erythrocytes life time will pull down the HbA1c from a patient with chronic kidney disease. Beside HbA1c, Glycated Albumin (GA) is an alternative glycemic marker. The aim of this study is to find out whether there is a comparison of HbA1c and glycated albumin levels in patients with type 2 DM with and without Chronic Kidney Disease (CKD). This research is an observational analytic study with a cross-sectional design. Conducted on 46 patients with DM type 2 with or without CKD at the Adam Malik Hospital, from August 2016 – December 2016 that fulfill the criteria, and after that, the HbA1c and GA were examined. The GA level inpatients with DM type II and CKD ( $18.48\pm5.23$ )%, were not significantly different from those patient with DM type II without CKD ( $17.39\pm6.07$ )%. From the statistical test result, there is no significant difference of GA from patient with DM type II with CKD and without CKD (p=0.519) and so does the HbA1c levels in type 2 DM patients with CKD ( $8.1\pm1.74$ )% were lower than those patient with type 2 DM without CKD ( $8.6\pm1.67$ )% although there was no significant difference between HbA1c level from patients with type 2 DM without CKD and with CKD (p=0.364) from the statistical test result. There is no significant difference between HbA1c level and glycated albumin from patients with DM type II with or without CKD.

Key word: Diabetes mellitus type 2, chronic kidney disease, HbA1c, glycated albumin

#### INTRODUCTION

Diabetes Mellitus (DM) is a group of metabolic diseases with characteristics of hyperglycemia that occur due to abnormal insulin secretion, insulin action, or both.<sup>1</sup> WHO predicted an increase in the number of DM patients in Indonesia from 8.4 million in 2000 to around 21.3 million in 2030. In line with WHO, the International DM Federation (IDF) in 2009 predicted an increase in the number of people with DM from 7.0 million in 2009 to 12.0 million in 2030.<sup>2</sup>

Chronic Kidney Disease (CKD), moreover, is a pathological state with various causes, resulting in progressive decline in kidney function and then ending in late stage kidney failure.<sup>3</sup> Based on the survey results of the Indonesian Nephrology Association (2009), the prevalence of CKD in Indonesia was 12.5%, or 18 million adults were affected by chronic kidney disease, and this figure then will continue to increase by around 10% every year.<sup>4</sup>

Furthermore, Riskesdas reported that the highest prevalence of chronic kidney failure was found in

patients aged  $\geq$  75 years, equal to 0.6 percent. Meanwhile, based on gender, the prevalence of chronic kidney failure in males in Indonesia was 0.3%, and 0.2% in females.<sup>5</sup> Based on the data of patients with kidney problems, 23% of the patients were reported along with diabetes mellitus.

Thus, every DM patient needs to be monitored regularly for his or her glycemic status to achieve good blood sugar level control status so that any complication does not occur.<sup>6</sup> Several clinical studies, such as Diabetes Mellitus Control and Complications Trial (DCCT), United Kingdom Prospective Study (UKPDS), and the Kumamoto study show that achieving lower levels of HbA1c with strict glycemic control can reduce the risk of developing some DM complications.<sup>7</sup>

Unfortunately, Okada *et al.* in their study stated that in DM patients with CKD markers best known for assessing glycemic still have not been identified.<sup>5</sup> HBA1c is a standard marker for assessing glycemic control in DM patients, but the value of HbA1c is influenced by factors related to the life span of erythrocytes.<sup>8</sup> Besides, in the condition of patients with end-stage renal disease requiring patients to undergo hemodialysis, the age of erythrocytes will be shorter. This then leads to a decrease in HbA1c levels so that blood glucose level checks using HbA1c cannot be used properly.<sup>9</sup>

Glycated albumin seems to be able to fill the weaknesses of HbA1c as a marker. For instance, HbA1c value is doubtful in several conditions, such as DM with severe anemia, DM with thalassemia, DM with hemodialysis, DM with pregnancy, Hb variants, as well as hemoglobinopathy abnormalities.<sup>10,11</sup> Therefore, this pre-research report aims to find out whether there are differences in HbA1c levels and GA levels in type 2 DM patients with and without CKD.

#### **METHODS**

This research was an analytic observational study with a cross-sectional design. This research was conducted on 46 patients with type 2 DM with and without CKD, who were treated at Adam Malik General Hospital in Medan from August to December 2016 and met inclusion criteria in this research. Next, those 46 patients with type 2 DM with and without CKD were then classified into two groups, namely Group I consisted of 23 types 2 DM patients with CKD and Group II consisted of 23 types 2 DM patients without CKD.

Moreover, this research was approved with ethical clearance obtained from the Medical Research Committee of FK-USU at the Adam Malik General Hospital in Medan. Informed consent was also requested in writing from the subjects of the research. Next, anamnesis and physical examinations were carried out, and the data of the examination results were recorded in the special status of the research. Blood samples then were taken from the mediacubital vein. A total of three mL of venous blood were taken and inserted into the EDTA tube. Subsequently, HbA1c examination was performed using the Thermo Fisher Scientific Indiko automated analyzer based on the principle of Turbidimetric Inhibition Immunoassay (TINIA), while glycated albumin examination was carried out after the plasma samples were collected using the Enzymatic Colorimetric examination method with the Photometer Automated Analyzer Architect Cl 8200.

Afterward, data analysis would have been performed using the SPSS version 19 program to find out differences in characteristics of type 2 DM patients with CKD and without CKD. Using the unpaired t-test if the data had been normally distributed, orusing the Mann-Whitney test if the data had not been normally distributed. The relation of HbA1c level and GA level in patients with type 2 DM with and without CKD then would have been analyzed either with Pearson correlation test if the data had been normally distributed or with Spearman's rho test if the data had not been normally distributed.

#### **RESULTS AND DISCUSSION**

In this research, 46 patients with type 2 DM aged 36-71 years were classified into two groups, namely Group I consisted of 23 types 2 DM patients with CKD and Group II consisted of 23 types 2 DM patients without CKD. Most of the research subjects were females as many as 26 people, compared to males as many as 20 people.

Moreover, Table 1 depicts that the average age of type 2 DM patients without CKD was 55.65 years old, younger than those type 2 DM patients with CKD with an average age of 57.61 years. Nevertheless, there was no statistically significant difference (p=0.521). Similarly, there was no difference in sex between type 2 DM patients with CKD and type 2 DM patients without CKD.

Furthermore, Table 2 illustrates the average level of GA in type 2 DM patients with CKD ( $18.48\pm5.32$ )%, not much different from type 2 DM patients without CKD ( $17.39\pm6.07$ )%. However, there was no significant difference in the levels of GA between the type 2 DM patients without CKD and those with CKD

Table 1. The comparison of type 2 DM patients without CKD and with CKD based on age and gender

Characteristics	Type 2 DM		n voluos
	Without CKD	With CKD	p-values
N (subjects)	23	23	
Sex			
М	11 (47.8%)	9(39.1%)	0.562
F	12 (52.2%)	14 (60.9%)	
Age (years old)			
mean±SD	55.65±9.69	57.61±10.8	0.521

Significant differences if p <0.05, the difference test uses the unpaired t-test

Characteristics	Type 2 DM		n-values
	Without CKD	With CKD	
n (subjects) Glycatedalbumin	23	23	
(Mean±SD)	(17.39±6.07)	(18.48±5.23)	0.519
HbA1c (Mean±SD)	(8.6±1.67)	(8.1±1.74)	0.364

Table 2. The comparison of GA and HbA1clevelsin type 2 DM patients without CKD and with CKD

Significant differences if p <0.05, the difference test used an unpaired t-test

with a value of p=0.519. On the other hand, the average level of HbA1c in type 2 DM patients with CKD  $(8.1\pm1.74)\%$  was lower than that in those without CKD  $(8.6\pm1.67)\%$ . Never the less, there was no significant difference in HbA1c levels between type 2 DM patients without CKD and those with CKD with a p-value of 0.364.

One of the complications of DM patients is CKD. To avoid or reduce this complication, the blood sugar levels of DM patients must always be controlled according to standardization set by ADA, WHO, or professional associations in each country.<sup>14</sup>

An examination of HbA1C level for long-term glucose control (3-4 months) actually has long been introduced as one of the laboratory tests with good results.<sup>3</sup> Unfortunately, this test is known to have weaknesses for DM patients who undergo the hemodialysis procedure. The test showed some flaws in the form of a lower test result when compared to another blood sugar control test, GA. Based on many previous researches, GA test is better than the HbA1c test to determine blood glucose control in DM patients undergoing hemodialysis procedures due to CKD.<sup>3</sup>

Hence, this research aims to compare HbA1c test to GA test in type 2 DM patients either with CKD or without CKD. The results of this research revealed that HbA1c level in type 2 DM patients without CKD was  $8.6\pm1.67\%$  (referent range <7%), while GA level in those patients was  $17.39\pm6.07\%$  (referent range <16%). On the other hand, HbA1c level in type 2 DM patients with CKD was  $8.1\pm1.74\%$  (reference range <7%), while GA level in those was  $18.48\pm5.23\%$ (reference range <16%).

Based on those data, the results of HbA1c and GA levels in the type 2 DM patients without CKD indicated that this group of patients had uncontrolled blood sugar levels since the results of both tests showed higher levels than normal ones (Table 2). Similarly, the results of HbA1c and GA levels in the group of type 2 DM patients with CKD were above normal references which means those patients had uncontrolled blood sugar levels.

Consequently, it can be said that both tests have good accuracy to be used as a long-term blood glucose control monitoring test in type 2 DM patients either with CKD or without CKD. This finding may be because in type 2 DM patients either with CKD or without CKD there is no change in erythrocyte survival leading to a decrease in HbA1c level.

Unlike in type 2 DM patients with or without CKD, the level of HbA1c in type 2 DM patients with End-Stage Renal Disease (ESRD) undergoing a hemodialysis procedure tends to be lower or controlled compared to the level of GA which tends to be higher indicating the uncontrolled condition. This occurs because type 2 DM patients with CKD undergoing hemodialysis procedures have a shorter survival of erythrocytes so that the number of young erythrocytes is getting higher and anemia is getting more severe (Table 2).

In addition, Table 2 showed that there was no significant difference in HbA1c levels between the group of type 2 DM patients with CKD and the group of type 2 DM patients without CKD. This indicates that the two groups of the study had poorly controlled blood sugar levels based on GA levels. Besides, Table 2 also illustrates that there was no difference in erythrocyte survival between in both groups as found in type 2 DM patients with ESRD undergoing hemodialysis procedures.

#### **CONCLUSION AND SUGGESTIONS**

The results of this research found that there was no significant difference in HbA1c and GA levels between type 2 DM patients with CKD and those without CKD. Hence, it can be concluded that HbA1c and GA levels can be used for monitoring glucose level control in type 2 DM patients either without CKD or with CKD.

With the results of this study HbA1c and Glicated Albumin (GA) levels can be used to monitor calcium levels in type 2 DM patients without CKD or with CKD.

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