CONTENTS

RESEARCH

Differences of Plasma Interleukin-6 and Tumor Necrosis Factor-A Levels in Healthy People, Rifampicin Resistant and Sensitive Pulmonary Tuberculosis Patients
Wahyu Setiani Wibowo, Jusak Nugraha, Soedarsono ................................................................. 129 - 134

Association between Specific Enolase Serum Levels and Outcome Acute Ischemic Stroke One Month After Onset
Yuri Haiga, Darwin Amir, Yuliarni Syafrita .................................................................................. 135 - 139

Analysis of Hemoglobin Levels And Leukocyte Count in Neonates with Hyperbilirubinemia
Dewi Suharti, Sulina Yanti Wibawa, Muthmainnah ................................................................. 140 - 144

Diagnostic Value of Ca-125 in Patients with Epithelial Ovarian Cancer at the Dr. Soetomo General Hospital Surabaya in 2016
Kintan P. R. Kania, Betty A. Tambunan, Willy Sandhika ................................................................ 145 - 149

Analysis of Vitamin D in Patients with Type 2 Diabetes Mellitus
Arfandhy Sanda, Uleng Bahrun, Ruland DN. Pakasi, Andi Makbul Aman ........................................ 150 - 154

Proportion of Rhesus Blood Phenotypes at the Blood Donor Unit in Bandung City
Ivana Dewi, Nadjwa Zamalek Dalimoenthe, Anna Tjandrawati, Nida Suraya ............................. 155 - 160

Correlation of Total Lymphocyte Count with CD4 Count in HIV/TB Coinfected Patients
Herniaty Rampo, Uleng Bahrun, Mansyur Arif ........................................................................... 161 - 164

Using Six Sigma to Evaluate Analytical Performance of Hematology Analyzer
Robiul Fuadi .................................................................................................................................... 165 - 169

Correlation of AA Index with Degree of Liver Fibrosis in Chronic Hepatitis B Patients
Rika Andriany, Ibrahim Abdul Samad, Mansyur Arif ................................................................. 170 - 173

Difference in HbA1c Level between Boronate Affinity and Ion Exchange-High Performance Liquid Chromatography Method in Diabetic Patient
Tuti Asryani, Ellyza Nasrul, Rikarni, Tutty Prihandani ............................................................... 174 - 179

Diagnostic Value of Neutrophil Lymphocyte Ratio to Differentiate Ischemic and Hemorrhagic Stroke
Martina Rentauli Sihombing, Liong Boy Kurniawan, Darwati Muhadi ..................................... 180 - 183

D-Dimer and Fibrinogen in Patients Underwent Surgery in Malignant and Benign Ovarian Tumor
Ismail Aswin, Herman Hariman, Fauzie Sahil .............................................................................. 184 - 190
Relationship between Specific Gravity of Cupric Sulfate and Saturation of Blood Droplets During Donor’s Hemoglobin Screening

**Resna Hermawati, Solichul Hadi** ................................................................. 191 - 193

Vancomycin-Resistant *Staphylococcus aureus* at the Dr. Wahidin Sudirohusodo Hospital Makassar

**Fatmawaty Ahmad, Nurhayana Sennang, Benny Rusli** ..................................................... 194 - 198

The Levels of Interleucin-6 (IL-6) and Tumor Necrosis Factor Alpha (TNF-ALFA) in Preeclampsia Patient and Normal Pregnancy

**Mawardi, Ratna Akbari Ganie, Sarma N. Lumbanraja** .......................................................... 199 - 201

Analysis of Platelet Volume Mean, Platelet Distribution Width, and Platelet Count in Hemorrhagic and Non-Hemorrhagic Stroke

**Gita Medita Sunusi, Darwati Muhadi, Mansyur Arif** ................................................................. 202 - 206

High Fluorescent Lymphocyte Count Examination in Dengue Hemorrhagic Patients with Sysmex Xn-1000 Hematology Analyzer

**Budiono Raharjo, Solichul Hadi** ............................................................................................. 207 - 210

Prevalence and Characteristics of Multidrug-Resistant *Acinetobacter baumannii* Cases at the Dr. Wahidin Sudirohusodo General Hospital in Makassar

**Dewi Kartika Tungadi, Nurhayana Sennang, Benny Rusli** ......................................................... 211 - 217

The Correlation of Anemia and Hepcidin Serum Levels in Regular Hemodialysis Patients with Chronic Hepatitis C

**Wingsar Indrawanto, Adi Koesoema Aman, Alwi Thamrin** .................................................. 218 - 223

The Comparison between HbA1c and Glycated Albumin Level Patient with Type II Diabetes Mellitus with or without CKD

**M. Rusli, Zulfikar, Santi Syafril** ................................................................................................. 224 - 227

Differentiation of Tγδ Lymphocyte Cells Expressing Interleukin-17 on Healthy Persons and Adult Acute Myeloid Leukemia Patients

**Elvan Dwi Widyadi, Yetti Hernaningsih, Endang Retnowati, Ugroseno, Ryzky Widi Atmaj** ........ 228 - 232

**LITERATURE REVIEW**

Hormone Examination in Menopause

**Ferdy Royland Marpaung, Trieva Verawaty Butarbutar, Sidarti Soehita** .................................. 233 - 239

**CASE REPORT**

Chronic Myelogeneous Leukemia Transformation into Acute Lymphoblastic Leukemia

**Endah Indriastuti, Arifoel Hajat** .............................................................................................. 240 - 245

Rapid Progression of Clavicular Solitary Plasmacytoma to Multiple Myeloma

**Hantoro Gunawan, Paulus Budiono Notopuro** ........................................................................... 246 - 249
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 in patients with DM type II and CKD (18.48±5.23)% were not significantly different from those patient with DM type II without CKD (17.39±6.07)%. 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±1.74)% were lower than those patient with type 2 DM without CKD (8.6±1.67)% 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.¹ 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 2030.² 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.³ 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.⁴

Furthermore, Riskesdas reported that the highest prevalence of chronic kidney failure was found in patients aged ≥ 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.⁵ 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.¹ 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.⁷

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.¹ 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.⁷ 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.  

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. 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 type 2 DM patients with CKD and Group II consisted of 23 type 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 mediocubital 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 CI8200.

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, or using 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 type 2 DM patients with CKD and Group II consisted of 23 type 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±5.32)%, not much different from type 2 DM patients without CKD (17.39±6.07)%. 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**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Type 2 DM</th>
<th>p-values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Without CKD</td>
<td>With CKD</td>
</tr>
<tr>
<td>N (subjects)</td>
<td>23</td>
<td>23</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>11 (47.8%)</td>
<td>9 (39.1%)</td>
</tr>
<tr>
<td>F</td>
<td>12 (52.2%)</td>
<td>14 (60.9%)</td>
</tr>
<tr>
<td>Age (years old)</td>
<td>55.65±9.69</td>
<td>57.61±10.8</td>
</tr>
</tbody>
</table>

Significant differences if p <0.05, the difference test uses the unpaired t-test
Table 2. The comparison of GA and HbA1c levels in type 2 DM patients without CKD and with CKD

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Type 2 DM Without CKD</th>
<th>Type 2 DM With CKD</th>
<th>p-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>n (subjects)</td>
<td>23</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>Glycated albumin (Mean±SD)</td>
<td>17.39±6.07</td>
<td>18.48±5.23</td>
<td>0.519</td>
</tr>
<tr>
<td>HbA1c (Mean±SD)</td>
<td>8.6±1.67</td>
<td>8.1±1.74</td>
<td>0.364</td>
</tr>
</tbody>
</table>

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±1.74)% was lower than that in those without CKD (8.6±1.67)%. 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.\(^1,4\)

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.\(^3\) 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.\(^3\)

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±1.67% (referent range <7%), while GA level in those patients was 17.39±6.07% (referent range <16%). On the other hand, HbA1c level in type 2 DM patients with CKD was 8.1±1.74% (referent range <7%), while GA level in those was 18.48±5.23% (referent 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 Glycated Albumin (GA) levels can be used to monitor calcium levels in type 2 DM patients without CKD or with CKD.
REFERENCES