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COMPARISON OF GLYCATED HEMOGLOBIN AND GLYCATED ALBUMIN IN TYPE 2 DM PATIENTS WITH AND WITHOUT CAD

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ABSTRACT

Diabetes has been associated with Coronary Artery Disease (CAD). The atherosclerosis, underlying the pathogenesis of CAD, has been activated since the early stages of hyperglycemia and accelerated with uncontrolled blood sugar level fluctuations. Therefore, sensitive glycemic markers are required to be used as a screening instrument such as a traditional glycated hemoglobin A1c (HbA1c) glycated hemoglobin marker and non-traditional Glycated Albumin (GA). This study was a cross-sectional conducted on May - July 2017 at the Adam Malik Hospital Medan. Subjects were patients with HbA1c> 7%, Hb> 10 g/dL and albumin> 3 g/dL, divided into DM+CAD and non-CAD DM groups. Sixty patients participated in this study consisting of 36 males (60%) and 24 females (40%), with a mean age of 56 years. There was a significant difference between HbA1c and GA between the non-CAD DM group and DM + CAD (p=0.001; 0.022.) Patient characteristics did not affect CAD complications in DM patients; a significant difference indicated that poor glycemic control increased the complication of CAD in patients with DM type 2. Glycated albumin examination is recommended for patients with type 2 diabetes with CAD.

Key words: Diabetes mellitus, coronary artery disease, HbA1c, glycated albumin

INTRODUCTION

The current pattern of diseases can be understood to be undergoing epidemiological transitions, such as the concept of changing health patterns and illness. The world is undergoing the III period of transition now, where degenerative diseases and pollutions are increasing. One of the rapidly rising degenerative diseases is Diabetes Mellitus (DM).[1]

The World Health Organization (WHO) estimated that 422 million adults suffered from DM in 2014. Indonesia's 10.1 million people are diagnosed as DM based on 2015 IDF data and ranks 7th in the world.[2,3]

One of the fatal cardiovascular complications is the incidence of Coronary Artery Disease (CAD) due to coronary artery narrowing caused by atherosclerosis or spasm, or a combination of both.[4,5]

The 2016 Heart Disease and Stroke Statistics update of the American Heart Association (AHA) recently reported that 15.5 million people aged ≥ 20 years in the United States experienced CAD.[6]

Whereas in Indonesia, in 2013 1.5% of the adult population was diagnosed or had CAD symptoms as one of the leading causes of death among DM patients and contributed more than 50% of DM deaths in some populations.[7]

Clinical studies have shown that atherosclerosis has been activated in the early stages of hyperglycemia, the progression of atherosclerosis is accelerated with high blood glucose fluctuations. Therefore, a sensitive glycemic marker is required and can be used as a tactile test device for hyperglycemic conditions. Some of the markers that have been investigated are traditional glycemic markers, e.g. glycated hemoglobin A1c (HbA1c), or non-traditional glycemic markers such as Glycated Albumin (GA).[7]

The advantage of HbA1c is its ability to reflect the average Blood Glucose (BG) approximately for 8-12 weeks, it can be checked at any time of the day and does not require any special preparation such as fasting. WHO, ADA, and PERKENI therefore recommended HbA1c.[5,8]

Several studies have shown that HbA1c levels are associated with the severity and progression of coronary atherosclerosis.[9]

The risk of microvascular complications increases exponentially as HbA1C increases. In contrast, any 1% reduction in HbA1c has been shown to be associated with a 37% reduction in the risk of microvascular complications and a 21% reduction in the risk of diabetes-related deaths.[10]

On the other hand, GA is a ketoamine formed as a result of a non-enzymatic process that binds glucose with a serum protein. In abnormal hyperglycemic conditions,

serum proteins are exposed to higher glucose concentrations and become more prone to glycation. Glycated albumin as a non-traditional glycemic marker has been widely developed, to assess the glycemic control of patients with short-term DM as well as the risk of complications due to the half-life of albumin, and other serum proteins shorter than red blood cells. Thus, GA measurements reflect the average glycemic load for a shorter duration of approximately 2-3 weeks.[11]

This study aimed to determine the characteristics distribution of type 2 diabetes mellitus with CAD complication and to compare HbA1c and GA value in DM + CAD patients and non-CAD DM with an expectation that GA examinations are faster and appropriate treatments could be given to the patients.

METHODS

This study was a cross-sectional conducted in the Department of Clinical Pathology Faculty of Medicine, University of North Sumatra/Adam Malik Hospital Medan in collaboration with the Department of Cardiovascular Disease and Vascular Medicine Faculty of Medicine, University of North Sumatra, during May until July 2017. Subjects were patients at the Adam Malik Hospital Medan diagnosed with type 2 DM with CAD and non-CAD type 2 DM, with HbA1c<7%, Hb>10 g/dL, albumin> 3 g/dL. Glycated albumin was performed by Architect CI 8200 Automatic Analyzer using the enzymatic colorimetric method, HbA1c was measured by BioRad-D10 instrument using High-Performance Liquid Chromatography (HPLC) principle.

All data processing was done using the Statistical Program for Social Science program (SPSS) version 22.0. To compare HbA1c and GA parameters in each category, paired T-test was used. Results were considered significant when P <0.05.

RESULTS AND DISCUSSION

The total number of samples were 60 with 30 samples of DM without CAD, and 30 samples of DM with CAD, according to specified criteria. Of all the data collected, there were more males than females in both groups.

This was finding consistent with the research conducted by Maskari et al., showing that diabetic patients with CAD complications were more common in males.[12] Another study conducted by Fox stated that the proportion of patients with DM who experienced CAD complications had increased in the last 50 years and most were found in males.[13]

Table.2. Distribution characteristics by sex

		Sex		Total
		Male	Female	
Group	Non-CAD	19	11	30
	CAD	17	13	30
Total		36	24	60

The mean age of the subjects was about 56 years in both groups. This was in line with research conducted by Maskari which showed that the prevalence of diabetic patients with and without complications increased with increased age and the mean age was 53 years, which were middle-aged.[12]

Table 3. Distribution characteristics by age

	Group	N	Mean	Std. Deviation
Age	Non-CAD	30	56.9231	7.68615
	CAD	30	56.3846	5.67947

The mean hemoglobin (Hb) level in the DM + CAD group was higher than the mean hemoglobin level in the non-CAD DM group.

Table 4. Distribution of characteristics based on hemoglobin level

	Group	N	Mean	Std. Deviation
Hb	DM + non-CAD	30	12.4462	1.75053
	CAD	30	13.2077	1.59868

Until now, researchers have not found other studies that supported it. The relationship between hemoglobin levels in patients with CAD DM and without CAD is not well known.

The mean albumin content in the DM + CAD group was lower than the mean albumin level in the non-CAD DM group.

Researchers found no other studies on albumin levels in patients CAD DM and without CAD. Comparison of Glycated Hemoglobin (HbA1c) and Glycated Albumin (GA) levels in non-CAD DM group and DM + CAD group.

The mean of HbA1C levels in DM with CAD group was higher than the non-CAD. The mean of GA levels in the group of DM with CAD was higher than DM without CAD. Based on the result analysis with the independent T-test, it could be concluded that there is a significant difference of HbA1C and GA between the non-CAD DM and CAD

Table 1. Subject characteristics

Characteristics		DM + CAD	DM non-CAD	Sig.
Sex	Male	17 (57%)	19 (64%)	0.691
	Female	13 (43%)	11 (36%)	
Age		56.38 ± 5.67	56.92 ± 7.68	0.841
Hemoglobin		13.21 ± 1.59	12.44 ± 1.75	0.258
Albumin		3.71 ± 0.36	3.73 ± 0.47	0.890

group with significance values of 0.001 and 0.022 (p <0.05), respectively.

Table 5. Distribution of characteristics based on albumin level

	Group	N	Mean	Std Deviation
Albumin	DM + non-CAD	30	3.7385	0.47353
	CAD	30	3.7154	0.36480

Ma et al.found the same conclussion the combination of GA and HbA1c is expected to increase predictive value for CAD and a reduction in GA levels will lead to a reduction in the incidence of CAD in patients with type 2 diabetes.[14]

Table 6. Comparison of HbA1c and GA levels in the research Subjects

	Group	N	Mean	Std. Deviation	Sig.
HbA1C	Non-CAD	30	8.57	1.04734	0.001
	CAD	30	10.20	1.20899	0.001
GA	Non-CAD	30	24.92	4.83841	0.022
	CAD	30	29.84	5.42903	0.023

CONCLUSIONS AND SUGGESTIONS

In this research, it all characteristics of research subjects had a p> 0.05, which indicated that the characteristics of patients did not affect the incidence of CAD complications in DM patients.

Significant differences in HbA1c and GA values were found in type 2 DM patients with CAD. This finding suggested that poor glycemic control may raise CAD complications in type 2 DM patients. It is expected that a combination of GA and HbA1c may increase the predictive value for CAD and a reduction in GA levels will lead to a reduction in the incidence of CAD in type 2 DM patients.

Based on the results of this study GA examination is recommended for patients with type 2 diabetes with CAD because GA examination is more reliable to assess glycemic control than HbA1c examination given that GA reflects blood glucose levels in the last 2-3 weeks. Also, GA levels are not influenced by factors affecting hemoglobin metabolism or erythropoietin therapy, only influenced by the value of albumin. The patients can get therapy more quickly and precisely. In addition, the clinician can also more quickly and precisely diagnose complications that may arise through GA checks.

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