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Analysis of The Comparison of HbA1c Measures in Diabetes Mellites Tipe 2 Patients with Complications and without Complications

Emyk Windartik^{1✉}, Eka Nur So'emah²

Universitas Bina Sehat PPNI

Email: emyk.windartik86@gmail.com^{1✉}

Abstrak

Diabetes melitus (DM) merupakan penyakit yang terjadi akibat rusaknya pankreas sehingga tidak dapat memproduksi insulin dalam jumlah yang cukup atau tidak dapat menggunakan insulin secara efektif. Hal ini dapat meningkatkan kadar gula darah dalam tubuh sehingga dapat memicu komplikasi DM. Untuk menghindari komplikasi tersebut diperlukan kontrol glikemik yaitu pemeriksaan kadar HbA1c secara rutin selama 3 bulan terakhir. Tujuan penelitian ini adalah menganalisis perbandingan kadar HbA1c pada Diabetes Mellitus Tipe 2 dengan komplikasi dan tanpa komplikasi. Desain penelitian observasional analitik dengan pendekatan cross sectional. Populasinya adalah seluruh pasien DM Tipe 2 di RSUD Bangil Pasuruan dengan metode random sampling sehingga diperoleh jumlah sampel sebanyak 60 pasien. Instrumen penelitian menggunakan data rekam medis pasien DM Tipe 2. Hasil analisis data menggunakan uji t diperoleh hasil perbandingan kadar HbA1c pada pasien DM dengan komplikasi dan tanpa komplikasi $p = 0,000$. Pasien DM dengan hiperglikemia yang tidak terkontrol dalam jangka panjang berisiko mengalami hipotensi, Infark CVA, dan kaki diabetik. Kadar glukosa darah yang tinggi menyebabkan perubahan jaringan saraf sehingga perlu dilakukan pemeriksaan kadar HbA1c secara rutin.

Kata Kunci: *Diabetes Mellitus Tipe 2, Kadar HbA1c*

Abstract

Diabetes mellitus (DM) is a disease that occurs due to damage to the pancreas so that it cannot produce enough insulin or cannot use the insulin effectively. This can increase blood sugar levels in the body, which can lead to complications of DM. To avoid these complications, glycaemic control is needed, namely checking HbA1c levels regularly for the last 3 months. The purpose of this study was to analyse the comparison of HbA1c levels in Type 2 Diabetes Mellitus with complications and without complications. Observational analytic research design with a cross sectional approach. The population was all Type 2 DM patients at Bangil Pasuruan Hospital with random sampling method so that a sample size of 60 patients was obtained. The research instrument used data from medical records of Type 2 DM patients. The results of data analysis using t test obtained the results of comparison of HbA1c levels in DM patients with complications and without complications $p = .000$. DM patients with long-term uncontrolled hyperglycaemia are at risk of developing hypotension, CVA Infarction and diabetic foot. High blood glucose levels cause nerve tissue changes so it is necessary to check HbA1c levels regularly.

Keywords: *Type 2 Diabetes Mellitus, HbA1c Level*

INTRODUCTION

Diabetes mellitus is a disease characterised by elevated blood sugar levels and metabolic disorders of carbohydrates, fats, and proteins associated with absolute or relative deficiency of insulin action and/or insulin secretion (Fatimah, 2015). Diabetes Mellitus control by checking HbA1c levels is also recommended by the American Diabetic Association (ADA) because it can describe the average blood sugar for the last 2-3 months so that it can be used as a reference for treatment planning and complications that will occur. HbA1c is a non-enzymatic binding of glucose molecules to haemoglobin through the post-translational glycation process. (Paret et al., 2020). Improper management of Diabetes Mellitus causes the patient's blood glucose to be difficult to control, causing various complications, such as diabetic neuropathy, stroke, blindness, and diabetic ulcers which affect the patient's quality of life. (Himawan et al., 2016).

The World Health Organisation (WHO) predicts an increase in the number of people with diabetes mellitus in Indonesia from 8.4 million in 2000 to around 21.3 million in 2030. The International Diabetes Federation (IDF) predicts an increase in the number of people with DM in Indonesia from 9.1 million in 2014 to 14.1 million in 2035 (Decroli, 2019). In 2021, the International Diabetes Federation (IDF) recorded 537 million adults (aged 20 - 79 years) or 1 in 10 people living with diabetes worldwide. Diabetes also causes 6.7 million deaths or 1 every 5 seconds. The International Diabetes Federation (IDF) notes that 537 million adults (aged 20-79 years) or 1 in 10 people are living with diabetes worldwide. (International

Diabetes Federation, 2021). The 2018 Riskesdas results show that the prevalence of Diabetes Mellitus in Indonesia based on a doctor's diagnosis in those aged > 15 years is 2%. This figure shows an increase compared to the prevalence of Diabetes Mellitus in the population > 15 years in the 2013 Riskesdas results of 1.5%. However, the prevalence of Diabetes Mellitus according to blood sugar test results increased from 6.9% in 2013 to 8.5% in 2018. (Kementerian Kesehatan RI., 2020). Based on the results of Riskesdas 2018, the prevalence of people with Diabetes Mellitus in East Java Province is 36.3%. While East Java Province is in the top 10 prevalence of diabetics in Indonesia or ranks ninth with a prevalence of 6.8. The number of people with diabetes in East Java per 6 years has increased starting from 2007-2019, in 2007 the number of people with diabetes mellitus was 275,462, in 2013 it was 605,974 and the highest number of increases in 2019 was 841,971 (Maulina Nur Annisa, Septi Winda Utami, 2021).

Measurement of blood glucose level only provides information on immediate glucose homeostasis and cannot be used to evaluate long-term glucose control (several weeks or months in advance). For this purpose, glycosylated haemoglobin in erythrocytes, also called glycosylated haemoglobin or haemoglobin A1c (HbA1c), is measured. (Barzkar et al., 2019). (Ghandour et al., 2018).

Management that can be done for diabetes mellitus cases by obeying the 4 pillars, which include regulating diet, doing physical activity, pharmacological therapy and education. In addition to the 4 pillars, people with DM are strongly required to carry out regular insulin therapy to prevent high blood sugar levels that lead to complications and are required to control blood sugar levels regularly. (Zhu et al., 2021). It aims to determine the status of blood sugar levels in Diabetes Mellitus patients in the normal, moderate or poor category so that it helps decide on prevention or management in accordance with the status of blood sugar levels in the body. So that checking HbA1c levels must be done regularly 3-4 months in order to determine metabolic control in the body. (Antari, 2017).

RESEARCH METHOD

Observational analytic research design with an observational approach. The variable in this study was HbA1c levels in Type 2 Diabetes Mellitus. The population in this study were all patients with type 2 diabetes mellitus at Bangil Pasuruan Hospital. The sample was 60 respondents who were taken by random sampling technique. The research instruments were the results of HbA1c examination and medical record data of Type 2 Diabetes Mellitus patients. Data analysis using t test.

RESULT AND DISCUSSION

| Characteristics of respondents | Respondents (n = 60) | |
|--------------------------------|----------------------|----|
| | f | % |
| Age | | |
| 26 - 35 year | 1 | 2 |
| 36 - 45 year | 6 | 10 |
| 46 - 55 year | 23 | 38 |
| 56 - 65 year | 22 | 37 |
| > 65 year | 8 | 13 |
| Gender | | |
| Female | 36 | 60 |
| Male | 24 | 40 |
| Time suffering DM | | |
| 1 - 2 year | 20 | 33 |
| 2 - 4 year | 10 | 17 |
| 4 - 6 year | 17 | 28 |
| 6 - 8 year | 8 | 13 |
| > 8 year | 5 | 9 |
| Complications | | |
| Complications | 40 | 67 |
| No Complications | 20 | 33 |
| Types of Complications | | |
| Hypertension | 9 | 15 |
| CVA Infarction | 11 | 18 |
| Pneumonia | 3 | 5 |
| Cardiovascular disease | 9 | 15 |
| Cronic Kydney Disease | 8 | 13 |
| No Complication | 20 | 34 |
| Level HbA1C | | |
| 4,0 - 6,0% | 0 | 0 |
| > 6 - 7% | 20 | 33 |
| > 7 - 8% | 2 | 3 |
| > 8% | 38 | 64 |

| Kadar HbA1c | N | Mean (Rerata) | Standar Deviasi | p* |
|--------------------|----|---------------|-----------------|-------|
| DM Complication | 40 | 10,083 | ,8127 | 0,000 |
| DM No Complication | 20 | 6,805 | ,1849 | 0,000 |

* t-independent

Based on HbA1c levels, the DM group with complications had an average HbA1c level > 8% which is a sign of uncontrolled diabetes mellitus, while the DM group without complications had an average HbA1c level < 7% which is a sign of well-controlled diabetes mellitus. The results of the analysis using the t-independent test showed that in both groups the p value of 0.000 < α 0.05 means that there is a correlation between HbA1c levels in diabetes mellitus patients with complications and those without complications. The HbA1c test is performed every two to three months to determine the overall glycaemic status and has a strong predictive value with regard to hyperglycaemia-related diabetic complications. By measuring HbA1c levels to determine the quality of diabetes mellitus disease control in the long term, so that the patient's compliance with meal planning and medication is known. In hyperglycaemia, blood glucose binds to haemoglobin so that HbA1c levels appear to increase. HbA1c can be used as a reference to assess the discipline and compliance of patients with type 2 diabetes mellitus in implementing treatment programmes, diet, and lifestyle changes. (Ghandour et al., 2018). The formation of glycated haemoglobin is a normal part of the physiological function cycle. However, as the average plasma glucose increases, so will the amount of glycated haemoglobin in the plasma. This specific biomarker characteristic of haemoglobin is used to estimate the average blood glucose two to three months ahead. (Sherwani et al., 2016). By measuring glycohemoglobin, we can determine the percentage of haemoglobin that contains sugar. (Barzkar et al., 2019). Type 2 diabetes mellitus is the most common type of diabetes, approximately 90%, which is characterised by hyperglycaemia in the context of insulin resistance and impaired insulin secretion. DM patients with long-term uncontrolled hyperglycaemia have risk factors including dyslipidaemia, hypertension, stroke and cardiovascular disease. (Liu et al., 2019). High levels of HbA1c identify high levels of blood glucose or blood glucose levels in patients with uncontrolled diabetes mellitus. If the blood glucose level is high, it causes the risk of complications in the cardiovascular system, nervous system, and urinary system. One of the conditions of hyperglycaemia in type 2 diabetes mellitus can cause high blood glucose levels when passing through blood vessels can stick to the walls of blood vessels causing an increase in blood pressure. This uncontrolled increase in blood pressure can also lead to

CVA. Patients with chronic complications are more likely to have higher HbA1c levels than DM patients without complications.

CONCLUSION

Based on the results of the study, it can be concluded that there is a difference in the average HbA1c levels between patients with type 2 DM accompanied by hypertension and type 2 DM without hypertension. With average HbA1c levels higher in the type 2 DM group with hypertension than the group without hypertension. So monitoring HBA1c levels can help prevent DM complications.

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