



Profile of Leukocytes Amount in Various Levels of HbA1c in Diabetics Mellitus

Aini Aini¹(✉), Jumari Ustiaty¹, and Rizal Pratama Adi Putra²

¹ Medical Laboratory Technology, Polytechnic of Medica Farma Husada Mataram, Mataram, NTB, Indonesia

ainie.mfh@gmail.com

² Medical Records and Health Information, Polytechnic of Medica Farma Husada Mataram, Mataram, NTB, Indonesia

Abstract. Blood glucose images in patients with diabetic mellitus (DM) can be assessed by measurements of glycated hemoglobin (HbA1c). HbA1c is formed because hyperglycemia forms a stable and settling bond. DM sufferers have increased proinflammatory cytokine production, such as interleukin 6 (IL-6) and interleukin 8 (IL-8) which will then spur the production of white blood cells. Leukocyte count plays an important role in the pathogenesis of insulin resistance and is one of the indicators of inflammation. The purpose of this study was to find out the profile of leukocytes at various levels of HbA1c with diabetic mellitus. The method of this research is an analytic observational with a cross-sectional approach. Data was collected and analyzed using non-parametric statistics for Spearman Rank Test. The results of this study show that at the average Normal HbA1c level, 6.39%, the average number of leukocytes is normal, which is 7.018 μ L, as well as the average level of HbA1c above normal, 9.26% the average number of leukocytes is normal 9,818 μ L. Based on the statistical test results obtained the significance value of 0.317 ($\alpha > 0.05$) with a correlation coefficient of 0.277. The conclusion of this study is an increase in the levels of HbA1c in patients with diabetic mellitus does not provide an overview of the increase in the number of leukocytes.

Keywords: Leukocyte · HbA1c · Diabetes mellitus

1 Introduction

Diabetes Mellitus (DM) is a non-communicable infection and a disease that is often experienced in various parts of the world. DM can be a cause of transmission 4–5 times more than other diseases in developing countries. The number of DM continues to this day, there are 177 million people with diabetes worldwide [1].

Indonesia is one of the top 10 countries with the largest DM sufferers in the world [2]. According to Riskesdas in 2013–2018, there was an increase in DM sufferers by 0.5% per population aged more than 15 years (Riskesdas, 2013, 2018). West Nusa Tenggara Province is one of the provinces that experienced an increase in the number of DM sufferers from 2013 to 2018, from 0.9% to 1.6% per population with age more than or

equal to 15 years. Awareness to check the percentage of health facilities in the province of NTB has increased from 0.8% to 1.2% which shows that awareness to check blood sugar levels regularly in diabetics is quite good [3].

The Mataram City Health Office detailed that DM is one of the top 10 in Mataram City with 1,313 sufferers in 2015 and 2017 as many as 10,740 people (Obstacles of Mataram City, 2018). Diabetes Mellitus (DM) can be an unrelenting infection due to a carbohydrate system disorder. In blood consistency (consistency) the blood becomes higher, causing blood flow to become, so that eventually the blood supply that comes to important organs is reduced, causing complications [4].

In DM, blood viscosity increases so that blood flow to organs is reduced. Lack of blood flow to organs causes tissue damage which in the early stages is in the form of micro and then macrovascular damage [5]. Tissue damage will be responded to by the body by increasing the number of leukocytes. In addition to tissue damage, lack of blood in tissues can cause oxidative stress [6]. Tissue damage either causes chronic inflammation or even cell death. This inflammation causes the hemopoietic system mainly by the bone marrow to release leukocytes into the circulation. Leukocytes in the circulation will increase in number. The increased number of leukocytes is useful for the body's defense and activates other leukocytes towards inflamed tissues [7].

The leukocyte count is one of the test parameters that is often used as an indicator of infection markers. An increase in the number of leukocytes is indicated as a development of diabetes mellitus infection. Research conducted by Prawitasari [6] states that there is a relationship between the number of leukocytes and blood glucose levels in people with diabetes mellitus.

HbA1c describes blood glucose levels 2 to 3 months before HbA1c becomes an assessment of the condition of diabetes for complications that will occur. HbA1c is used as an indicator that can measure blood glucose levels in the previous 2 to 2 months because HbA1c will bind to erythrocytes so that the age of erythrocytes in the blood is used as a benchmark for measuring HbA1c [8].

Diabetes mellitus occurs due to lack of insulin production by pancreatic beta cells or damage to the pancreas or both complications of diabetes mellitus can occur vascular complications such as microangiopathy, retinopathy, nephropathy, cardiomyopathy, neuropathy [9]. Inflammatory reactions consist of two major groups, namely vascular reactions and cellular reactions that cause an increase in blood cells, one of which is leukocyte cells [10]. The purpose of this study was to determine the profile of the leukocyte count in various variations in HbA1c levels in patients with diabetes mellitus.

2 Research Method

2.1 Design of Research

This research is an analytic observational education with a cross-sectional approach. Cross-sectional is a research design by making measurements or observations at the same time (once a time) between risk factors/exposure with disease.

2.2 Tools, Materials, and Research Samples

Tourniquet, Holder, Flashback Needle, Vacutainer tube, Alcohol cotton, plaster, HbA1cQuo-Test t, Automatic Hematology: Sysmex XN 1000, EDTA'S blood, Cartridge HbA1c.

3 Results and Discussion

In the Table 1, the average HbA1c level of 6.38% and the average number of leukocytes of 7,018/ μ L was not a Diabetic Mellitus sufferer at the Mataram City Hospital. The average result of the two parameters is still in the normal category.

The average HbA1C level was 9.26% and the average number of leukocytes was 7,818/ μ L in people with diabetes mellitus at the Mataram City Hospital. The average HbA1c level in the sample group shows results above normal value, while the average number of leukocytes is still in the normal category [8].

Table 1. The Results of the HbA1c Value Measurement with the Number of Leukocytes.

HbA1c level interval	HbA1c level (%)	Number of leukocytes (μ L)	Information
Normal (6%–7%)	6.2	4.900	Normal
	6.3	6.520	Normal
	6.3	8.770	Normal
	6.3	7.630	Normal
	6.8	7.270	Normal
Average	6,38	7.018	
Above normal (>7%)	7.3	6.470	Normal
	7.5	7.750	Normal
	7.7	9.740	Normal
	8.0	10.800	Above normal
	8.9	8.520	Normal
	9.3	5.100	Normal
	9.4	5.860	Normal
	9.6	7.410	Normal
	11.8	10.500	Above normal
	13.1	6.030	Normal
Average	9,26	7.818	

Note: Normal value HbA1c: <7%

Normal value of leukocytes: 4.000/ μ L–10.000/ μ L

			HbA1c	Leukosit
Spearman's rho	HbA1c	Correlation Coefficient	1.000	.277
		Sig. (2-tailed)	.	.317
		N	15	15
	Leukosit	Correlation Coefficient	.277	1.000
		Sig. (2-tailed)	.317	.
		N	15	15

HbA1c examination is used to monitor hyperglycemia in patients with diabetes mellitus [11]. The limit of the controlled HbA1c value is 7% because it can reduce the risk of complications and is included in the uncontrolled category if the HbA1c value is 7% [12].

Polymorphonuclear and mononuclear leukocytes can be activated by advanced glycation end products (AGEs), oxidative stress, angiotensin II and cytokines in hyperglycemic [11]. The picture of blood glucose can be assessed by measuring glycated hemoglobin HbA1c used as control and long-term monitoring which describes blood glucose 2–3 months earlier and can be used as a consideration and assessment of diabetic patients against the risk of complications that will occur [13]. Several previous studies have shown that the leukocyte count in type 2 DM is controlled and uncontrolled, but based on blood glucose values [14, 15].

The results of a previous study conducted by Gonie [15] which measured the number of leukocytes in patients with uncontrolled and controlled diabetes mellitus, it was found that the minimum number of leukocytes in patients with uncontrolled diabetes mellitus was $4.1 \times 103/\mu\text{L}$ and the maximum number was $21.5 \times 103/\mu\text{L}$. Meanwhile, in patients with controlled diabetes mellitus, the minimum leukocyte count was $3.09 \text{ per mi} \times 103/\mu\text{L}$ and the highest number was $19.58 \times 103/\mu\text{L}$. The difference between this study and previous studies is that it does not compare the profile of the leukocyte count with the HbA1c value in the study [9] only measures the number of leukocytes in patients based on inclusion criteria and does not mention the number of blood glucose levels. The results of this study also showed that the average HbA1c level was above normal, 9.26% the average number of normal leukocytes was $9.818 \mu\text{L}$ with a significance value of 0.317 ($\alpha > 0.05$) with a correlation coefficient of 0.277.

4 Conclusion

The conclusion of this study is an increase in the levels of HbA1c in patients with diabetic mellitus does not provide an overview of the increase in the number of leukocytes.

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