THE RELATIONSHIP OF SMOKING HABITS WITH HBA1C LEVELS IN TYPE TWO DM PATIENTS AT GOTONG ROYONG HOSPITAL

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ABSTRACT

Introduction: Diabetes Mellitus (DM) is a disease whose prevalence continues to increase every year. In 2019, Indonesia was ranked number 7 with the highest number of DM sufferers, namely 10.7 million. Diabetes mellitus is a chronic metabolic disease characterized by increased blood glucose levels, this occurs because there is not enough insulin produced by the pancreas or a condition where the body cannot use the insulin produced effectively. One examination that can be used to assess a patient's glycemic control is the Glycated Hemoglobin (HbA1c) examination. Smoking habit is known to be a risk factor for diabetes mellitus. Even though there are many disadvantages, the number of smokers in Indonesia is still difficult to reduce due to the lack of education and control regulations that suppress smoking behavior in society. This causes smoking to become a risk factor for many uncontrolled diseases in the world of health.
Objective: The aim of this study was to analyze the relationship between smoking habits and HbA1c levels in male patients with type two DM at the Gotong Royong Hospital.
Method: This research uses observational analytical research with a case control study approach. In the research sample, namely type two Diabetes Mellitus patients who had their HbA1c levels checked at the Gotong Royong Hospital, a questionnaire was completed regarding the patient's smoking habits. From the results of the questionnaire, patients will be classified into non-smokers, light smokers, moderate smokers, and heavy smokers.
Result: There is no significant relationship between smoking habits and HbA1c levels in type two diabetes mellitus patients at Gotong Royong Hospital with a p-value=0.681.

Keyword: diabetes mellitus, smoking habit, HbA1c levels

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INTRODUCTION

The number of Diabetes Mellitus (DM) sufferers increases every year. The World Health Organization reports that between 1980 and 2014, the number of people with diabetes mellitus increased from 108 million to 422 million. With 10.7 million cases in 2019, Indonesia is the seventh country most affected by diabetes. Diabetes complications include blindness, cardiovascular disease, and kidney failure.[1,2]

Controlling blood sugar is a good way for DM sufferers to prevent various complications that can occur. Good glycemic control is to monitor glycated hemoglobin (HbA1c), which gives you an idea of your glucose levels over the past two to three months. A person is said to have DM if their HbA1c level is 6.5% or higher. The increased risk of problems is two times greater in patients with HbA1c levels of more than 7%.[3]

Diabetes Mellitus can be caused by several things. There are two types of risk factors: modifiable factors and non- modifiable factors. variables that cannot be changed include age and family history of diabetes; Variables that can be changed include being overweight or obese, not exercising enough, having high blood pressure, a lot of stress, and smoking. Tobacco plants (Nicotiana tabacum, Nicotiana rustica, or hybrids of these and other species) provide the raw material for making cigarettes. When a cigarette is burned, it releases smoke that contains nicotine, tar, and possibly other substances.[4] Nicotine works in the body by binding and activating nicotinic acetylcholine receptors (nAChRs). With the activation of nAChRs in the adrenal medulla, catecholamines which will later influence the cardiovascular system and metabolic responses are also increased. The effects of nicotine include increasing heart rate and blood pressure, releasing free fatty acids, and mobilizing blood sugar, all of which are caused by the release of catecholamines in the bloodstream. This effect is the opposite of the effect of insulin. Nicotine affects insulin secretion by activating catecholamine hormones and disrupting pancreatic β cells, leading to insulin resistance; hence, it affects blood sugar levels.[5]

Asian and Australian populations have the highest levels of tobacco consumption, namely 57%, followed by Eastern European populations at 14%, Americans at 12%, Western Europeans at 9%, and people in the Middle East and Africa at 8%. 10% of the world's population who are smokers are ASEAN. For the ASEAN region itself, it is spread to 46.16% for the Indonesian population, and 16.62% for the Filipino population. In the

Indonesian region itself, the 5 provinces that have the highest proportion are Riau Islands Province with 27.1%, Bengkulu with 27.1%, West Java with 27.1%, Gorontalo with 26.8% and also NTB with 21.1% .[6]

Research by Nor Latifah and Purwo Setiyo Nugroho in 2020 did not find any relationship between smoking habits and the prevalence of diabetes mellitus in the employee population of the Palaran Community Health Center in 2019 in Samarinda City. However, research conducted by Deny Sutrisna Wiatma and Wuhlisin Amin shows a statistically significant correlation between smoking and increased blood sugar levels. Due to contradictory findings in other studies, researchers were interested in conducting this investigation. Researchers used the HbA1c level variable because the number of studies linking smoking habits with HbA1c levels is very minimal.[6,7]

METHODS

An analysis methodology based on case control observations was used in this study. Two hundred and seventeen male patients with type 2 diabetes mellitus who underwent HbA1c level examination at Gotong Royong Hospital were the cohort used in this study. The sampling method used was a "purposive sampling" strategy, namely selecting subjects based on predetermined standards. In this study, based on the inclusion criteria, these criteria include:

- Male patient suffering from type 2 DM at Gotong Royong Hospital.
- Male patients who are willing to be respondents and have signed Informed Consent.
- Male patients who have been undergoing oral diabetes therapy for > 1 year and take medication regularly.
- Male patient who is an active smoker.
- Male patient who uses filter cigarettes.
- Male patients aged in the range of 45- 59 years.
- Male patient who has no history of contact with cigarette smoke.

Then the exclusion criteria include:

- Male patient who takes steroid medication regularly.
- Male patients who have anemia or hemoglobin or erythrocyte abnormalities.
- Male patients who are obese or have a BMI above 30 kg/m2.

The selection of 32 patients for this investigation was based on these calculations and criteria. The hypothesis test in this study was carried out using the Mann Whitney test and Spearman correlation because the independent and

dependent variables in this research used an ordinal scale.

RESULT

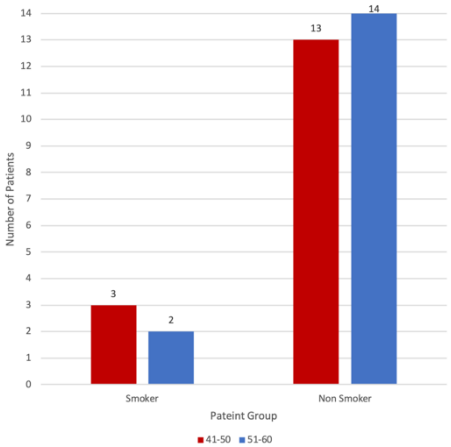

Figure 1. Sample Characteristics Based on Age and Smoking Habits

Based on Figure 1, there are 3 type 2 diabetes mellitus patients who smoke between the ages of 41 and 50 years, and 13 patients between the ages of 51 and 60 years. Meanwhile, 2 people (aged between 41 and 50 years) and 14 people (aged between 51 and 60 years) with type 2 diabetes mellitus who had never smoked were involved.

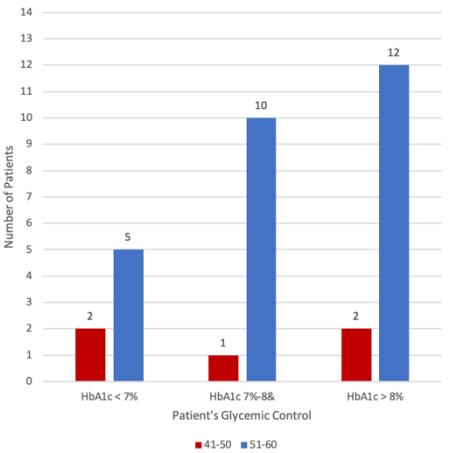

Figure 2. Sample Characteristics Based on Age and Glycemic Control

Figure 2 shows that in the 41-50 and 51-60 year age groups, respectively, there are 2 and 5 type 2 diabetes mellitus patients who have satisfactory glycemic control. Then, there was one person aged between 41 and 50 years and ten people aged between 51 and 60 years who had moderate glycemic control in their type 2 diabetes mellitus. Two people in the age group 41-50 years and twelve people in the age group 51-60 years were found to have type 2 diabetes mellitus with poor glycemic control.

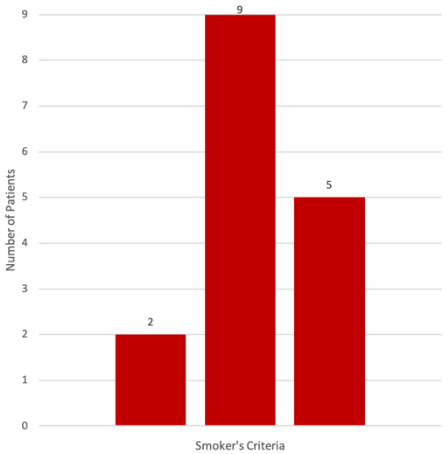

Figure 3. Sample Characteristics Based on Smoker Criteria

Based on Figure 3, the number of patients with type two diabetes mellitus who are light smokers is 2 people, 9 patients who are moderate smokers, and 5 patients who are heavy smokers.

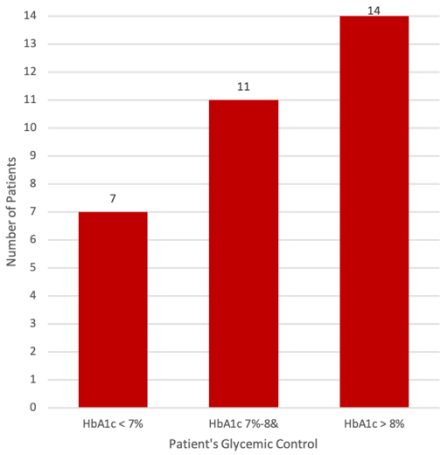

Figure 4. Sample Characteristics Based on HbA1c Level Examination Results

Based on Figure 4, it was found that the number of patients with type 2 diabetes mellitus who had good glycemic control or HbA1c level examination results <7% was 7 people, patients with moderate glycemic control or HbA1c level examination results 7% - 8% were 11 people, and patients with poor glycemic control or examination results of HbA1c levels >8% were 14 people.

Table 1. Distribution of Smoker HbA1c Examination Results Based on Smoker Criteria

Smoker criteria	Median (%)	Frequency (n)	Std. Deviation	Coefficient Variant (%)
Non	7.8	16	2.07	26.4
Light	7.2	2	0.70	9.8
Moderate	8.2	9	2.46	29.8
Heavy	8.9	5	1.68	18.9
Total	7.9	32	2.08	26.3

Based on table 1, the median value obtained from the results of examination of HbA1c levels for type two diabetes mellitus patients who have no history of smoking is 7.8% with a total of 16 people and a standard deviation of 2.0, for patients who are light smokers it is 7.2% with a total of 2 people with a standard deviation of 0.7, 8.2% of patients who were moderate smokers with a total of 9 people and a standard deviation of 2.4, and patients who were heavy smokers were 8.9% with a total of 5 people with a standard deviation of 1.6. The total number of patients as a whole had a median HbA1c test result of 7.9% with a total of 32 people and a standard deviation of 2.08.

Table 2 Mann Whitney Statistical Test Results

Smoker Criteria		n	Mean Rank	Sum of Ranks	p-value
HbA1c	**Smoker**	2	3.50	7.00	0.207
	2.00	9	6.56	59.00	
	Total	11			

Table 3 Spearman Correlation Statistical Test Results

			HbA1c	Smoker Criteria
Spearman's rho	**HbA1c**	**Correlation Coefficient**	1.000	0.076
		Sig. (2-tailed)	-	0.681
		n	32	32
	Smoker Criteria	**Correlation Coefficient**	0.076	1.000
		Sig. (2-tailed)	0.681	-
		n	32	32

The results were obtained based on table 2 and table 3. Differences in the results of examining HbA1c levels with good, moderate and poor glycemic control in each subject's smoking category; without a history of smoking, light smokers, moderate smokers and heavy smokers were determined by carrying out the Mann Whitney test. The significance value is 0.207, where the results obtained are > 0.05, which means there is no difference in the results of checking HbA1c levels in each category of smoking degree.

Next, researchers used data from examining HbA1c levels by smoking

category, patients with a history of smoking and those without to carry out the Spearman Correlation test. This will help us understand the relationship between smoking habits and HbA1c levels in type 2 diabetes mellitus patients. There is no statistically significant correlation between smoking and HbA1c levels in type 2 diabetes mellitus patients, because the results are significant at 0.681 and the p value is more than 0 .05. Here we find support for the null hypothesis (H0) which states there is no relationship between smoking and hemoglobin A1c levels in male patients with type 2 diabetes mellitus treated at Gotong Royong Hospital.

DISCUSSION

Based on Figure 5.1 and Figure 5.2, the data obtained shows that the largest number of diabetes mellitus patients with good, moderate or poor glycemic control is aged 51 to 60 years, both for patients who have a history of smoking and those without a history of smoking. Apart from the smoking habit of half of the total study sample, it is known that as a person gets older, their intolerance to glucose will also increase. The reason behind this is that pancreatic β cells gradually become smaller with age. As a result, the production of the insulin hormone is disrupted, causing an increase in blood sugar levels.[7]

Patients with type 2 diabetes mellitus who had never smoked before and those who had smoked in the past comprised two parts of the study sample. The research began by carrying out a Mann Whitney test on the research results. There were no significant differences between the HbA1c levels of the four categories of smokers. The significance value obtained was 0.207, where this figure was > 0.05. In diabetes mellitus sufferers, this shows that smoking is not correlated with HbA1c levels.

In line with previous research, these findings show that patients with type 2 diabetes mellitus and a history of smoking do not have significant differences in HbA1c levels compared with patients without a history of smoking. The findings of this study are consistent with research by Rahim, AR in 2023 which found no correlation between smoking and the prevalence of uncontrolled type 2 diabetes mellitus.[8,9]

This research shows results that are not in line with the theory stated by the World Health Organization (WHO) which states that tobacco use is strongly associated with an increased risk of developing type 2 diabetes. In 2013, Vlassopoulos, A. found that compared to non-smokers, those who smoking has 0.08% higher HbA1c values, and heavy smokers have 0.14% higher HbA1c levels. The nicotine contained in cigarettes will cause a decrease in insulin sensitivity and decrease glucose uptake by

muscles. This will result in an increase in insulin resistance. Cigarette smoke contains nicotine which activates catecholamine hormones, inhibits insulin function, and disrupts pancreatic β cells thereby reducing insulin secretion. Nicotine influences insulin secretion in pancreatic β cells via nAChRs. Pancreatic islets and pancreatic β cells may have functional nicotinic receptors, according to some studies. The presence of nicotine-sensitive neural nicotinic receptors in pancreatic cells provides a switch for modulating the physiological function of pancreatic cells by acetylcholine and is involved in tobacco toxicity. This explains that the activity of pancreatic β cells may be negatively influenced by the nicotine contained in cigarettes. Decreased insulin secretion and continued increase in insulin resistance will keep the patient's blood glucose high.[10,11,12]

The research results differ from theory due to many risk factors for increasing HbA1c levels that cannot be studied because of limitations in the research such as the type of oral medication consumed by the patient, physical activity or exercise routine, food intake, stress level and lifestyle of diabetes patients. type two mellitus was the research sample. The results of this study also cannot represent all type two diabetes mellitus patients who smoke and who do not smoke because the study population is relatively small. Table 5.1 shows that the highest median HbA1c test result was in the heavy smoker category, then the lowest was in the light smoker category. However, light smokers only have a frequency of 2 people so it cannot describe the overall results.

CONCLUSION

Based on the results of the research that has been carried out, several conclusions can be drawn, namely:

1. The average result of checking HbA1c levels in patients who have a smoking habit is 8.9%. These average results indicate that most diabetes mellitus patients who have a history of smoking have poor glycemic control.
2. The average result of checking HbA1c levels in patients who do not have a smoking habit is 8.4%. These average results show that most diabetes mellitus patients who do not have a history of smoking also have poor glycemic control, although the numbers are still better than patients with a history of smoking.
3. There is no significant relationship between smoking habits and HbA1c levels in type two diabetes mellitus patients at the Gotong Royong Hospital.

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