The Correlation of Medication Adherence in Patients with Type 2 Diabetes and the Incident of Hypertension in Primary Health Care Setting

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ABSTRACT:

Background: The global incidence and prevalence of type 2 diabetes mellitus has continued to increase over the past three decades and is expected to triple by 2030.[1] Based on data from the World Health Organization (WHO), in 2021, 1.28 billion adults worldwide have hypertension.[4] In relation to type 2 DM therapy, patient non-compliance in undergoing treatment can cause failure to control blood sugar levels and can cause cardiovascular complications.[5]

Objective: To determine the relationship between adherence to medication consumption in people with type 2 diabetes mellitus and the incidence of hypertension.

Methods: This study used an analytical descriptive method with cross sectional design. Sampling used consecutive sampling techniques with the sample size obtained using the Slovin formula, where the population was 447, resulting in a total sample of 218 respondents who made the inclusion and exclusion criteria. Primary data was obtained from the Medication Adherence Rating Scale-10 (MARS-10) questionnaire which was filled in by the respondent and the respondent's blood pressure was checked by automatic sphygmomanometer Kenz AC-05P. Data was analyzed using SPSS-25 software with the chi- square test.

Results: From 218 respondents, 80 respondents were non-adherent in taking medication and suffered from hypertension (90.9%) and 8 respondents were non-adherent in taking medication and did not suffer from hypertension (9.1%). There were 29 respondents who adhered to taking medication and suffered from hypertension (22.3%) and 101 respondents who adhered to taking medication and did not suffer from hypertension (77.7%). These results obtained a p-value of 0.000 <0.05, which means there is a relationship between adherence to drug consumption in patients with type 2 diabetes mellitus and the incidence of hypertension.

Conclusion: There is a relationship between adherence to drug consumption in patients with type 2 diabetes mellitus and the occurrence of hypertension at Puskesmas Sentosa Baru and Puskesmas Sering in Medan City.

KEYWORDS: Adherence, Hypertension, Type 2 diabetes mellitus

INTRODUCTION

The incidence and prevalence of type 2 diabetes mellitus has been increasing globally for the past three decades and is expected to triple by 2030.[1] In 2021, the number of people with diabetes mellitus reached 537 million, and is expected to continue to increase to 642.7 million people in 2030 and 783.2 million people in 2045. 90% of the total people with diabetes mellitus are type 2 diabetes mellitus. The Southeast Asian region is the third largest contributor to diabetes, accounting for 90.2 million of the total diabetes population worldwide. Indonesia is ranked 5th with the largest diabetes population in the age of 20-79 years, reaching 19.5 million people.[2] The results of RISKESDAS by the Indonesian Ministry of Health in 2018 showed that the prevalence of diabetes mellitus increased to 8.5% from 6.9% in 2013.[3]

The prevalence of hypertension globally and nationally has also increased. Based on data from the World Health Organization (WHO) data in 2021, the number of adults worldwide suffering from hypertension has increased to 1.28 billion.[4] Meanwhile, in Indonesia, according to RISKESDAS 2018, there was an increase in the prevalence of hypertension to 34.1% from the previous 25.8% in 2013.[3]

Adherence is one of the determining factors of successful patient therapy in addition to other factors such as accuracy in drug selection, accuracy of treatment regimen and support of a healthy lifestyle from the patient. Non-compliance can cause patients to lose the benefits of therapy and possibly result in a gradual worsening of the condition.[5]

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Based on research conducted at the Immanuel Manado clinic, the level of non-adherence of type 2 DM patients was 62.22% and patients who were adherence were 37.78%.[6] From research conducted at the Adabraka polyclinic in Accra also showed that the level of non-adherence to eating medication was still high at 63.2% and showed that uncontrolled diastolic blood pressure and high glucose levels were associated with non-adherence to taking medication.[7]

Based on this, the researcher is interested in conducting research on the relationship between drug consumption compliance in patients with type 2 Diabetes Mellitus with the incidence of hypertension at Sentosa Baru Health Center and often Medan City in 2023.

METHODS

This research is an analytic descriptive with a *cross sectional study* design. This study was conducted in the period of August 2023 to September 2023 which was carried out at puskesmas Sering Kota Medan and puskesmas Sentosa Baru Kota Medan, North Sumatra. The population of this study were all patients with type 2 diabetes mellitus who came during January - July 2023. Sampling of this study was determined based on inclusion criteria such as patients who filled out *informed consent*, patients with type 2 diabetes mellitus, and patients who received pharmacological therapy for type 2 diabetes mellitus. Exclusion criteria consist of patients who are not available as research samples. The sampling technique with the *Quota Sampling* Technique and the sample size was determined by the slovin formula with a population of 477 so that a sample size of 218 was obtained. Data collection using primary data obtained using questionnaires and *sphygmomanometer* devices conducted directly to respondents. The questionnaire consisted of the respondent's identity, *informed consent*, and medical records. To assess compliance using the MARS-10 *(Medication Adherence Rating Scale)* questionnaire.[8] The measurement results of the adherence questionnaire in the form of MARS-10 total score 1-5 are non-compliant and total score 6-10 are compliant. The questionnaire was distributed directly to respondents at the health center. The *sphygmomanometer was* used to measure the respondents' blood pressure. Data processing was collected and processed using a *computer statistical* program and then the data was analyzed using SPSS-25 software. Data were analyzed univariately using descriptive statistics and bivariate analysis using the *Chi-square* test. This study has received approval from the Health Research Ethics Committee of the Faculty of Medicine, Muhammadiyah University of North Sumatra with letter number: 1045/KEPK/FKUMSU/2023.

RESULTS

The total number of patients with type 2 diabetes mellitus who became the sample of this study was 218 people. Characteristics of patients including gender, age, occupation, education level, smoking habits and history of hypertension can be observed in Table 1.

Table 1. Characteristics of Type 2 Diabetes Mellitus Patients

Patient Characteristics	Number (n)	Precentage (%)
Gender		
Female	163	74,8
Male	55	25,5
Age		
26-35	2	0,9
36-45	7	3,2
45-55	32	14,7
56-65	80	36,7
>65	97	44,5
Job based		
Employee	53	24,3
Unemployment	165	75,7
Education		
Elementary	4	1,8
Junior high	20	9,2
Senior high	128	58,7
Diploma	14	6,4
Bachelor	50	22,9
Post graduate	2	0,9
Smoking Habit		
Smoking	56	25,7

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No smoking	162	74,3
Hypertension		
Yes	109	50,0
No	109	50,0

Table 1. explains that the characteristics of patients with type 2 diabetes mellitus based on the gender of the respondents were mostly female 163 respondents (74.8%), based on the age of the elderly, namely 97 respondents (44.5%), based on the employment of respondents who did not work 165 respondents (75.7%), based on the level of education of high school graduates / equivalent as many as 128 respondents (58.7%), based on smoking habits 162 respondents (74.3%) and based on respondents who experienced hypertension as many as 109 respondents (50.0%).

Table 2. Characteristics of Medication Adherence in Type 2 Diabetes Mellitus Patients

Medication Adherence	Number (N)	Percentage (%)
Non-compliant	88	40,4
Compliant	130	59,6
Total	218	100

Table 2. Explains that 88 (48.4%) patients with type 2 diabetes mellitus were not compliant with taking medication and 130 (59.6%) were compliant with taking medication.

Table 3. Results of Analysis of the Relationship Between Adherence to Drug Consumption in Patients with Type 2 Diabetes Mellitus with Hypertension

Treatment Adherence	Hypertension				Total		p-value
	Yes		No				
	f	%	f	%	f	%	
Non-compliant	88	90,9	8	9,1	88	100	
Compliant	29	22,3	101	77,7	130	100	0,000
Total	109	50	109	50	218	100	

In Table 3. obtained a p-value of 0.000 <0.05, which means that there is an association between drug consumption compliance in patients with type 2 diabetes mellitus with the incidence of hypertension.

DISCUSSION

The results of this study showed that the characteristics of patients with type 2 diabetes mellitus based on gender were mostly female (74.8%). These results are in accordance with research conducted previously which states that of the total 96 respondents, 53% of respondents were female. This research is also in accordance with the results of previous research which states that of the total 2057 respondents, 1383 respondents were female (67.23%).[9,10]

This happens because the female gender has an association between estradiol and insulin resistance. Another study mentioned that women with type 2 diabetes mellitus have an association with high levels of testosterone and low levels of *sex hormone-binding globulin* (SHBG).[9] In addition, there are underlying factors such as lack of exercise and physical activity. Another reason that type 2 diabetes mellitus is more common in women is due to differences in sexual hormone levels and body composition between women and men. The decrease in estrogen concentration in menopausal women causes an increase in fat reserves in the body, especially in the abdomen, this condition causes insulin resistance which is a risk factor for type 2 diabetes mellitus. Gender differences in glucose homeostasis, but the mechanism is not well known.[10]

The results of this study indicate that the highest incidence of diabetes mellitus occurred at the age level of the elderly, namely 97 respondents (44.5%). This is in accordance with research conducted previously which states that the highest incidence of diabetes mellitus occurs at the age level of the elderly, namely 41 respondents (40.6%) of 101 respondents. Because elderly people often experience systemic exacerbation of chronic inflammation, decreased mitochondrial function, tissue dysfunction, oxidative stress, DNA damage, and these conditions contribute to forming metabolic disorders. Aging is also associated with increased levels of pro-inflammatory molecules.[11]

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In addition, age-related variations in body composition lead to an increase in fat mass, especially visceral adiposity, and a similar decrease in muscle and bone mass. Aging also impairs insulin secretion from β-cells in response to endogenous incretins, is associated with decreased insulin sensitivity, and promotes β-cell death by inducing mitochondrial dysfunction. In elderly subjects, abnormalities in insulin sensitivity and insulin secretion gradually lead to impaired glucose tolerance and consequent clinical symptoms of diabetes mellitus.[12]

Based on occupation, this study found that 165 respondents did not work, namely 75.7%. The results of this study are in line with research conducted by Fibra 2021 where as many as 65% of respondents have moderate mild degree jobs which include not working, housewives, civil servants, BUMN and private employees. The results of this study are also supported by other research, namely respondents who did not work had the highest number of results, namely 35.1%. When the body does physical activity, the use of glucose in the muscles will be more than when the body is at rest. Physical activity is a pillar of DM management with the aim of improving insulin sensitivity and helping glucose enter cells.[13]

The most recent education characteristics were high school graduates, as many as 128 respondents (58.7%). According to previous research this has an influence on the incidence of DM disease. People with a high level of education will usually have a lot of knowledge about health. With this knowledge, people will have awareness in maintaining their health. The higher the level of education, the higher the knowledge and awareness of a person to seek treatment.[14] The level of education can affect a person's ability and knowledge in implementing healthy living behavior. Respondents with higher education will have broader knowledge than respondents with low education levels. The higher the level of education, the higher the ability of a person to maintain a healthy lifestyle. Respondents with low education can have good behavior obtained from the experience of undergoing the treatment process.[14]

The results of this study indicate that based on smoking habits in patients with type 2 diabetes mellitus, most are found not to have a smoking habit, namely 162 (74.3%) compared to those who have a smoking habit 56 (25.7%). This is not in accordance with the research concucted previously which states that smoking is associated with the incidence of type 2 diabetes mellitus.[15] In addition, several meta-analysis studies in the same research stated that there is an increased risk of type 2 diabetes mellitus by 40% in smokers.[15] Smoking is a risk factor that can be changed in diabetes mellitus. Cigarettes and other tobacco products contain several addictive chemicals that impact metabolic health. Cigarette exposure induces oxidative stress that affects blood glucose levels, altering blood glucose homeostasis and causing insulin resistance. In addition, exposure to cigarettes is also associated with vascular damage, endothelial dysfunction, and activation of the blood coagulation cascade which further increases the risk of microvascular and macrovascular complications in patients with type 2 diabetes mellitus.[16]

The results of this study indicate that based on adherence to taking medication in patients with type 2 diabetes mellitus, most are found to be compliant with taking medication, namely 130 (59.6%) compared to those who are not compliant with taking medication, namely 88 (40.4%). This is in accordance with previous research which states that the level of compliance with taking medication in patients with type 2 diabetes mellitus is very high. This may be influenced by the consistency of Mandau Health Center health workers who always remind patients to control and take medicine to the health center.[17] In this study, health workers at both Puskesmas Sentosa Baru and Puskesmas Sering also always remind patients with type 2 diabetes mellitus to control and take drugs to the puskesmas according to a predetermined schedule. In a previously conducted study stated that globally the proportion of adherence to taking medication in patients with type 2 diabetes mellitus varies from 25-91%. Adherence to taking medication plays an important role in achieving optimal therapeutic success by maximizing drug effects, and is significantly correlated with blood sugar levels.[18]

The results of this study differ from previous research conducted in Cameroon which states that out of a total of 195 patients with type 2 diabetes mellitus, 106 (54.4%) patients were not compliant in taking medication due to several factors such as young age, using insulin, and consuming alcohol. In addition, some of the reasons for respondents who were not compliant with type 2 diabetes mellitus treatment included forgetting, financial problems, improvement of symptoms felt, and busyness carried out by patients. The same study also mentioned that patients with type 2 diabetes mellitus with insulin monotherapy were twice as likely to be non-adherent compared to patients who received oral therapy. This may be mainly due to the fear and discomfort experienced by patients when having to inject insulin subcutaneously.[18]

In this study, 109 patients with type 2 diabetes mellitus (50%) suffered from hypertension and 109 patients with type 2 diabetes mellitus did not suffer from hypertension (50%). So that the results of this study are not in line with previous research which states that there were 36 patients with diabetes mellitus did not suffer from hypertension (72%) and 14 patients with diabetes mellitus suffered from hypertension (28%).[19] The results of this study are not in line with previous researchwhere the study said there were 70.5% of patients with diabetes mellitus suffering from hypertension.[20]

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Risk factors such as older age, male gender, smoking history, high salt diet and obesity greatly influence the occurrence of hypertension in patients with diabetes mellitus. Factors such as activity and a good lifestyle and the duration of diabetes mellitus can affect the non- occurrence of hypertension in patients with diabetes mellitus.[21-23]

This study shows that there is a relationship between drug consumption compliance in patients with type 2 diabetes mellitus with the incidence of hypertension with a p-value of 0.000 <0.05. According to previous research this is because the state of hyperglycemia is often associated with the incidence of hyperinsulinemia, dyslipidemia, and hypertension which simultaneously initiates the occurrence of cardiovascular disease and stroke.[24]

In a previous study conducted at the Sako Palembang health center, from 24 total research samples it was found that there were still many who were not compliant with taking drugs with a percentage of 71%, this study was conducted in 2 stages of measuring blood pressure carried out in patients with type 2 diabetes mellitus. In stage 1, it was found that 17 patients (70.83%) had hypertension and 7 patients (29.17%) had normal blood pressure. Then in the second stage, which was carried out 2 weeks after the first stage of measurement, the results of hypertension were 6 patients (25%) while the results of normal blood pressure were 18 patients (75%). This change in results is because people with diabetes mellitus are indicated to be able to control their blood sugar levels by obediently taking medication. The study explained that uncontrolled blood sugar levels in the body can cause various complications in patients with type 2 diabetes mellitus, one of the complications that often occurs is macroangiopathy, namely complications in large blood vessels that affect blood pressure.[25]

CONCLUSION

Research that has been conducted at Puskesmas Sentosa Baru and Puskesmas Sering regarding the relationship between drug consumption compliance in type 2 diabetes mellitus patients with the incidence of hypertension can be concluded that the characteristics based on gender are mostly female 163 respondents (74.8%). Characteristics based on age were 97 respondents (44.5%). Characteristics based on the most work are those who do not work 165 respondents (75.7%). Characteristics based on education level were mostly high school graduates 128 respondents (58.7%). The characteristics based on smoking habits were that most did not have a smoking habit 162 respondents (74.3%). Compliance with drug consumption of patients with type 2 diabetes mellitus is most compliant with taking medication 130 respondents (59.6%). The incidence of hypertension in patients with type 2 diabetes mellitus is the same as that of patients with type 2 diabetes mellitus without hypertension at Puskesmas Sering and Puskesmas Sentosa Baru, 109 respondents (50.0%). There is a relationship with a p-value of 0.000 <0.05 between drug consumption compliance in patients with type 2 diabetes mellitus and the incidence of hypertension.

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