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Original Research Article

Relationship of Random Blood Sugar to the Incidence of Diabetic Neuropathy Pain in Patients with Type 2 Diabetes Mellitus at the Trowulan Health Center,Mojokerto Regency

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Abstract

Diabetes mellitus has an understanding in which the body's metabolic disease causes high glucose in the blood and the cases are still quite high and are predicted to increase every year both in terms of morbidity and mortality. Glycemic control in type 2 diabetes mellitus patients is known to be one of the factors causing complications, namely diabetic neuropathy pain, one of which is GDS. The symptoms that can be caused are the sensation of pain in the extremities and even numbness. The purpose of this study was to determine the relationship between transient blood sugar levels and the incidence of diabetic neuropathy pain. The number of samples in this study was conducted on 93 respondents who had type 2 diabetes mellitus and data collection used a total sampling technique. The research design used was cross sectional with an analytic observational research design. Data was collected using medical records of Prolanis patients at the Trowulan Health Center, Mojokerto Regency, who had T2DM and analyzed using the chi-square test with a p-value of 0.032 and an OR of 4.147. The conclusion that can be drawn in this study is that there is a relationship between random blood sugar levels and the incidence of diabetic neuropathy pain in patients with type 2 diabetes mellitus at the Trowulan Health Center, Mojokerto Regency.

***Key word** : Random blood sugar, Diabetes melitus thype 2, Neuropathy diabetic pain*

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INTRODUCTION

Diabetes mellitus has an understanding where the body's metabolic disease causes high glucose in the blood and the cases are still quite high and are predicted to increase every year. Type 2 DM cases in 2018 in East Java amounted to 2.6% and the number of DM sufferers in Mojokerto Regency was 44,600 people in 2020. The most common complication found from DMT2 is diabetic neuropathy pain where the case in the world is 50.8%. It is known that the incidence of diabetic neuropathy in T2DM patients at the Trowulan Community Health Center, Mojokerto Regency, is in the 5th largest disease in the Prolanis program (Kebede et al., 2021).

Glycemic control is one of the important factors in the emergence of the development of complications of diabetic neuropathy pain, one of which is seen from the high blood sugar levels at

any time. This is related to the condition of hyperglycemia which can damage nerve fibers so that the nerves cannot transmit signals to the brain or there is a decrease in the speed of nerve conduction and causes a person to experience disturbances in the sense of taste, both pain and even numbness in the affected area (Putri et al., 2020).

With this background, researchers wanted to find out whether there is a relationship between random blood sugar levels and the incidence of diabetic neuropathy pain in patients with type 2 diabetes mellitus at the Trowulan Health Center, Mojokerto Regency.

MATERIAL AND METHODS

This type of research includes quantitative research with an analytic observational research design and a cross-sectional research design. This research was conducted from February to May 2023 at the Trowulan Community Health Center, Mojokerto Regency. Retrieval of data used using total sampling technique with a total sample of 93 respondents. Data collection was carried out using the medical record data of Prolanis patients at the Trowulan Health Center, Mojokerto Regency who had T2DM and were analyzed using the chi-square test with a significance value = 0.05. Univariate and bivariate analysis methods were used in this study to determine the relationship between random blood sugar levels in T2DM patients and the incidence of diabetic neuropathy pain.

RESULT

Characteristics of Responden

Table 1 : Distribution of Respondents Age

No	Respondent's age	Amount	%
1.	≤55 years	12	12,9 %
2.	>55 years	81	87,1 %
	Amount	93	100 %

Table 1 shows that the most respondents are > 55 years old, namely 87.1% (81 respondents) and the least ≤ 55year of 12.9% (12 respondents).

Table 2 : Distribution of Respondents Gender

No	Gender	Amount	%
1.	Man	29	31,2 %
2.	Woman	64	68,8 %
	Amount	93	100 %

Table 2 shows that most of the respondents were dominated by the female sex, namely 68.8% (64 respondents) and the least percentage were male respondents, namely 31.2% (29 respondents).

Table 3 : Distribution of Length of Suffering from T2DM

No	Duration of suffering	Amount	%
1.	≤5 year	27	29 %
2.	>5 year	66	71 %
	Amount	93	100 %

Table 3 shows that the highest percentage is a respondent with a duration of DMT2> 5 years, namely 71.0% (66 respondents) and the least≤ 5 years by 29% (27 respondents).

Table 4 : Distribution of Respondents' NND Events

No	NND Incident	Amount	%
1.	Non-NND	12	12,9 %
2.	NND	81	87,1 %
	Amount	93	100 %

Table 4 shows that of the 93 respondents who experienced diabetic neuropathy pain in DMT2 patients at the Trowulan Health Center, Mojokerto Regency, that was 87.1% (81 respondents) and 12.9% (12 respondents) did not experience NND.

Table 5 : Distribution of Respondents' GDS Levels

No	GDS rate	Amount	%
1.	Normal	43	46,2 %
2.	Abnormal	50	53,8 %
	Amount	93	100 %

Table 5, shows that of the 93 respondents who had blood sugar levels when they were not normal in DMT2 patients at the Trowulan Health Center, Mojokerto Regency, namely 53.8% (50 respondents) and respondents who had normal GDS levels were 46.2% (43 respondents).

Table 6 : Distribution of Respondents' GDS Levels

	Neurophaty Status		**Amount**	***P-Value***	**OR**
	NND (n=81)	Non-NND (n=12)			
Random blood sugar					
Abnormal (≥ 200 mg/dL)	47	3	43	0,032	4,147
Normal (<200 mg/dL)	34	9	50		
Amount	81	12	93		

Based on table 6 above, it shows that 47 respondents experienced NND with abnormal GDS levels and 34 respondents with normal GDS levels. In addition, there were 3 respondents who did not experience NND at abnormal GDS levels and 9 respondents with normal GDS levels. The p-value is 0.032 which means H0 is rejected and H1 is accepted. In addition, the OR value in this study was 4.417 which means that someone with abnormal blood sugar levels has a risk of 4.147 times compared to normal GDS levels for NND events.

DISCUSSION

The results of research related to GDS with the development of complications of NND showed that the p-value was 0.032 ($p \leq 0.05$) and the OR value was 4.147. This research is the same as the results of research conducted by Supriyadi and Susmini (2019) where the results of their research show a statistically significant p value with a value of 0.002. The results of this study prove that abnormal blood sugar levels correlate with the incidence of diabetic neuropathy pain.

Glycemic control is an important factor in the emergence of complications of diabetic neuropathy pain. The polyol pathway is one of the pathways that is activated during hyperglycemia in type 2 DM. It starts with hyperglycemia where glucose in the blood is converted into sorbitol with the help of the enzyme aldoreductase. Furthermore, sorbitol will be converted into fructose with the help of the enzyme sorbitol dehydrogenase. Excessive accumulation of sorbitol intracellularly can cause the first to decrease myoinositol which will affect decreased sensation or damage to peripheral nerves, especially in the foot area and sufferers are also at high risk for experiencing minor injuries or even diabetic ulcers. In addition, the accumulation of sorbitol causes intracellular AGEs to also increase where these AGEs will bind to their receptors and can then cause the process of cell apoptosis which will then cause inflammation of the nerves, cause pain, and interfere with the activity of nerve signal transmission. Both of these conditions contribute to the incidence of diabetic neuropathy pain in a person. The symptoms that are often felt, for example, often experience pain in the extremities, especially in the legs, a feeling of heat or tingling, or even numbness (Dinker R Pai, 2013).

From table 5 in the bivariate analysis above, it appears that diabetic neuropathy pain can also occur in T2DM patients with normal GDS levels. This is possible because NND does not only occur due to abnormal GDS levels. There are other factors that can cause this condition, for example, from the gender and age of the respondents. Some theoretical sources say that women have a higher risk of complications than men in diabetes mellitus, namely the occurrence of NND. This is related to the hormonal differences between women and men. High levels of estrogen in women can result in disruption of the formation of iodine which has an important role in the process of forming nerve myelin. Meanwhile, the male hormone testosterone has a function to protect the body from type 2 diabetes mellitus. According to Ahgniya (2017) diabetes mellitus also tends to be experienced by postmenopausal women. Hormonal linkages are still the culprit in this condition. The hormone progesterone is known as anti-insulin which makes cells less sensitive to insulin which can then lead to conditions of insulin resistance. This has an effect on increasing blood sugar levels in a person, especially in women. Research conducted by Supriyadi (2019) showed that many female respondents experienced symptoms of peripheral neuropathy with a percentage of 59.4% (Aghniya 2017; Beata, Matasak and Siwu, 2018).

Based on several studies, it is said that there is a relationship between age and the incidence of NND. In theory, as you get older, the risk of developing diabetic neuropathy pain complications will also increase. The aging process also causes the function of organs in the body to decrease, including the ability of beta cells to produce insulin so that it can cause a condition of hyperglycemia in a person. Not only that, the aging process also causes a decrease in cell activity in muscle mitochondria which then results in an increase in body fat levels. This of course can lead to insulin resistance. One study was conducted by Ian (2021), which stated that many respondents aged > 55 years experienced diabetic neuropathy pain with a percentage of 71.43% (Tofure, Huwae and Astuty, 2021).

CONCLUSION

Based on the results of the data analysis obtained, the conclusions that can be drawn are as follows:

1. The characteristics of the respondents in this study were that the majority of respondents were female, aged > 55 years, experienced NND events of 87.1%, and random abnormal blood sugar levels of 53.8%.
2. There is a relationship between random blood sugar levels and the incidence of diabetic neuropathy pain in T2DM patients at the Trowulan Health Center, Mojokerto Regency.

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