

SELF-MANAGEMENT BEHAVIOR AND SUSPECTED DIABETIC PERIPHERAL NEUROPATHY IN PATIENTS WITH TYPE 2 DIABETES MELLITUS

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ABSTRACT

Background: Peripheral neuropathy is a complication of type 2 diabetes mellitus (T2DM) that can reduce patients' quality of life. Blood glucose control through self-management behavior is one approach to preventing this complication. However, the association between self-management behavior and peripheral neuropathy in patients with T2DM warrants further investigation. **Objective:** To determine the association between self-management behavior and suspected diabetic peripheral neuropathy (DPN) in patients with T2DM in Sumbang District, Banyumas. **Methods:** An analytical observational study with a cross-sectional design was conducted among 55 patients with T2DM selected using purposive sampling. Self-management behavior was assessed using the Diabetes Self-Management Questionnaire (DSMQ), while suspected DPN was assessed using the Indonesian version of the Diabetic Neuropathy Symptom (DNS) questionnaire. Bivariate analysis was conducted using the chi-square test, and multivariate analysis was conducted using logistic regression. **Results:** A total of 46 respondents (83.6%) demonstrated good self-management behavior, while 45 (81.8%) screened positive for suspected DPN. The chi-square test found no significant association between self-management behavior and suspected DPN ($p = 0.198$). In contrast, HbA1c was significantly associated with suspected DPN ($p = 0.001$). Logistic regression showed that poor HbA1c control was associated with increased odds of suspected DPN (OR = 23.268; 95% CI: 3.790–142.858; $p = 0.001$). **Conclusion:** No significant association was found between self-management behavior and suspected DPN among patients with T2DM in Sumbang District, Banyumas. HbA1c was significantly associated with suspected DPN, underscoring the importance of glycemic control and neuropathy assessment in the management of patients with T2DM.

Keywords: Type 2 Diabetes Mellitus, Self-Management Behavior, Suspected Diabetic Peripheral Neuropathy

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INTRODUCTION

Indonesia is a developing country facing a range of public health challenges, including diabetes mellitus (DM). DM is a chronic disease characterized by elevated blood glucose levels (hyperglycemia) (ADA, 2021). According to the World Health Organization (WHO), DM ranks fourth among the leading causes of death worldwide. Approximately 422 million people have DM, with the majority living in developing countries (WHO, 2024). Data from the 2018 Basic Health Research survey indicate that approximately 20.4 million people in Indonesia have diabetes (PERKENI, 2021; IDF, 2021). The prevalence of DM has also increased in several Indonesian provinces, including Central Java, where it reached 15.6% in 2022 (Central Java Provincial Health Office, 2022).

DM can cause both macrovascular and microvascular complications. Macrovascular complications include atherosclerosis, coronary heart disease, and myocardial infarction, whereas microvascular complications include neuropathy, nephropathy, and retinopathy. Peripheral neuropathy is one of the most common microvascular complications of DM and can reduce patients' quality of life (PERKENI, 2021). Globally, the prevalence of peripheral neuropathy among patients with T2DM is approximately 50.8% (Rachmantoko et al., 2021). Peripheral neuropathy is more prevalent in Southeast Asian countries, including Indonesia, where its prevalence reaches 58% (Malik et al., 2020).

Chronic hyperglycemia activates the polyol pathway, leading to reduced nerve growth factor (NGF), the production of reactive oxygen species (ROS), and the formation of advanced glycation end products (AGEs). These processes ultimately cause endothelial dysfunction, compromising the structural integrity of blood vessel walls and resulting in endothelial weakness and damage. Consequently, nerve impulse transmission is disrupted, contributing to the development of neuropathy (Subekti, 2019). Nerve damage can affect the autonomic, motor, and sensory nervous systems (Wahyuni et al., 2021).

In general, peripheral neuropathy in patients with T2DM can be prevented through effective blood glucose control. Key components of glycemic control include dietary management, regular physical activity, pharmacological treatment, foot care, and consistent blood glucose monitoring (PERKENI, 2021; Bagus et al., 2023). Self-management refers to actions taken by individuals to manage their disease (Larasati et al., 2020). Self-management behavior should include essential aspects of blood glucose control to achieve the desired glycemic targets. Patients with good self-management have 3.349 times better glucose control than those with poor self-management (Ramadhani et al., 2019). Failure to adhere to self-management practices can result in serious complications and even death (Handayani et al., 2019). In 2023, 599 people with DM were recorded in Sumbang District, Banyumas, and all had received health services in accordance with established standards (Banyumas District Health Office, 2023). Nevertheless, no similar studies have been conducted, and no records are available regarding the number of cases of DM-related peripheral neuropathy in Sumbang District. Therefore, this study investigated the association between self-management behavior and suspected DPN in patients with T2DM in Sumbang District, Banyumas.

RESEARCH METHOD

This analytical observational study used a cross-sectional design. Primary data were collected by assessing self-management behavior and suspected DPN. The study population consisted of patients with T2DM enrolled in the Chronic Disease Management Program (Prolanis) in Sumbang District, Banyumas. The study sample comprised Prolanis patients with T2DM in the district who met the inclusion and exclusion criteria. The inclusion criteria were: (1) a diagnosis of T2DM documented in the medical record; (2) registration as a Prolanis participant in Sumbang District, Banyumas; (3) willingness to participate and

provide informed consent after receiving an explanation of the study; and (4) ability to communicate and complete the study interview and questionnaires. The exclusion criteria were inability to complete the questionnaire and the absence of, or inability to verify, HbA1c data in the medical record. The independent variable was self-management behavior, and the dependent variable was suspected DPN. Purposive sampling was used, and the sample consisted of 55 participants.

Data were collected using questionnaires and medical records. The Diabetes Self-Management Questionnaire (DSMQ) was used to assess self-management behavior, and the Indonesian version of the Diabetic Neuropathy Symptom (DNS) questionnaire was used to assess suspected DPN. This study received ethical approval from the Health Research Ethics Committee of the Faculty of Medicine, Jenderal Soedirman University (approval reference: 063/KEPK/PE/VII/2024). The study was conducted in Sumbang District, Banyumas, from September to October 2024. Data on diabetes self-management behavior and suspected DPN were collected through structured interviews using the prepared questionnaires. Respondents answered the questions, and the researcher recorded their responses. HbA1c data were obtained from laboratory tests conducted within the previous three months and documented in the medical records. The inclusion and exclusion criteria were then applied to identify 55 eligible participants. The data were subsequently processed and analyzed to assess associations between the study variables.

Data analysis was conducted in three stages. Univariate analysis was used to describe the distribution of respondent characteristics and study variables, with results presented in tables. Respondent characteristics included age, sex, income, HbA1c level, and duration of diabetes. The study variables were self-management behavior and suspected DPN. Bivariate analysis was performed using the chi-square test, with a significance level of 0.05 ($p < 0.05$), to assess the association between the variables. Multivariate logistic regression was used to identify factors associated with suspected DPN.

RESULT AND DISSCUSSION

Result

The analysis included 55 participants who provided consent and met the inclusion and exclusion criteria.

Table 1. Characteristics of Patients with Type 2 Diabetes Mellitus

Variable	Frequency	Persentage
Sex		
Male	10	18.2%
Female	45	81.8%
Age		
18-44 Years	1	1.8%
45-65 Years	40	72.7%
>65 Years	14	25.5%
Income		
<UMR	49	89.1%
≥UMR	6	10.9%
Duration Diabetes		
5-10	36	65.5%
>10	19	34.5%
HbA1c		

Good	15	27.3%
Poor	40	72.7%
SMDM		
Good	46	83.6%
Poor	9	16.4%
DPN		
Negative	10	18.2%
Positive	45	81.8%
Total	55	100%

A total of 55 patients with T2DM participated in the study. Most respondents were female (81.8%) and aged 45–65 years (72.7%). Forty-nine respondents (89.1%) had an income below the UMR. Most had had diabetes for 5–10 years (65.5%), and 40 (72.7%) had poor HbA1c control. Regarding diabetes self-management behavior (SMDM), 46 respondents (83.6%) demonstrated good self-management. Most respondents screened positive for suspected DPN (45; 81.8%).

Table 2. Self-Management Behavior and HbA1c with Suspected DPN

Variable	<i>Suspect DPN</i>				Total		P-Value
	Negative		Positive		n	%	
	n	%	n	%			
SMDM							
Good	7	12.7	39	70.9	46	83.6	0.198
Poor	3	5.5	6	10.9	9	16.4	
HbA1c							
Good	8	14.5	7	12.7	15	27.3	0.001
Poor	2	3.6	38	69.1	40	72.7	

Table 2 presents the bivariate analysis using the chi-square test. HbA1c was significantly associated with suspected DPN ($p = 0.001$; $p < 0.05$). In contrast, self-management behavior was not significantly associated with suspected DPN among patients with T2DM ($p = 0.198$; $p > 0.05$). A further analysis was conducted using logistic regression to identify factors associated with suspected DPN among patients with T2DM. As shown in Table 3, HbA1c was significantly associated with suspected DPN ($p = 0.001$; $p < 0.05$), with an OR of 23.268.

Table 3. Multivariate Analysis of Factors Associated with Suspected DPN

Variable	p	OR (95%)
SMDM	0.242	0.287 (0.036 – 2.319)
HbA1c	0.001	23.268 (3.790 – 142.858)
Constant	0.006	1.098 (3.786 – 124.539)

Discussion

In this study, the number of female patients with T2DM was higher than the number of male patients. This finding is consistent with a study by Mildawati et al. (2019), which reported that women accounted for 59 (71.1%) of the 83 patients diagnosed with T2DM. Women may be at greater risk of T2DM than men because they tend to have higher cholesterol levels and differ in their activity patterns and lifestyles, factors that may influence T2DM incidence (Arania et al., 2021; Susilawati & Rahmawati, 2021). However, according

to the IDF, the prevalence of T2DM is higher among men than women—9.65% versus 9%, respectively (IDF, 2021). This discrepancy may reflect sampling-related bias, as the data obtained may not represent the actual population distribution. Most patients in this study were aged 45–65 years (40; 72.7%). This is consistent with Mildawati et al. (2019), who found that people aged 45–65 years were the age group most susceptible to DM. The higher occurrence of neuropathy in this age group may be related to age-associated tissue damage caused by free radicals, including increased lipid peroxide levels and changes in enzyme activity (Amelia et al., 2019).

Most patients with T2DM in this study had an income below the UMR (49; 89.1%). This finding is similar to that of Unhanisyah et al. (2023), who reported that most respondents had incomes below the UMR (72; 77.4%). Income can influence a person's ability to manage diabetes. Financial constraints may limit access to information, care, and treatment. Lower income may therefore be associated with a higher risk of diabetes complications (Unhanisyah et al., 2023). In this study, 65.5% of patients had had diabetes for 5–10 years, while the remaining 34.5% had had the disease for more than 10 years. Pfannkuche et al. (2020) reported that DPN occurred in 19% of patients with T2DM after 5–10 years and increased to 36% among those with diabetes for more than 10 years. The longer a person has diabetes, the greater the likelihood of complications; in other words, diabetes-related complications tend to increase with disease duration (Mildawati et al., 2019).

Poor HbA1c control was prevalent among patients with T2DM: 40 (72.7%) had poor HbA1c levels. A similar finding was reported by Haryati et al. (2022), who found that most patients with T2DM had uncontrolled blood glucose levels (94%). Poorly controlled HbA1c in patients with T2DM can lead to chronic hyperglycemia, which contributes to the development of various complications (Haryati et al., 2022). Most respondents in this study demonstrated good diabetes self-management behavior (46; 83.6%). However, 39 of these 46 respondents (84.8%) screened positive for suspected DPN. Among those with poor self-management behavior, 6 of 9 respondents (66.7%) screened positive. These findings suggest that a “good” self-management score on a questionnaire does not necessarily mean that peripheral neuropathy symptoms are absent at the time of assessment.

Statistically, this study found no significant association between SMDM behavior and suspected DPN ($p = 0.198$). This finding should be interpreted with caution. The absence of a statistically significant association does not necessarily indicate that self-management plays no role in diabetes control or complication prevention. Rather, this study did not provide sufficient statistical evidence to establish an association between self-management behavior category and suspected DPN in the sample examined. In addition, the poor-SMDM group was relatively small, comprising only nine participants, which limited the study's ability to detect differences between groups.

Glycemic control should be considered when interpreting these findings. In this study, 40 respondents (72.7%) had poor HbA1c control, and HbA1c was significantly associated with suspected DPN ($p = 0.001$). Logistic regression also showed an OR of 23.268 for HbA1c (95% CI: 3.790–142.858). This indicates a strong association between HbA1c category and suspected DPN in this sample. However, because the study used a cross-sectional design, these findings cannot establish a causal relationship. HbA1c reflects average blood glucose exposure over approximately the 2–3 months preceding measurement. It therefore provides information about glycemic control that cannot be obtained solely by assessing behavior through a questionnaire. Patients may report good self-care practices without necessarily achieving their glycemic targets. This discrepancy may be influenced by several factors, including diabetes duration, the extent of metabolic dysfunction, treatment regimens, adherence to pharmacological therapy, and individual clinical conditions.

The DSMQ assesses diabetes self-management behavior, whereas HbA1c is a biochemical indicator of glycemic control. These measures assess different aspects of diabetes management and should not be considered interchangeable. A good self-management score does not directly demonstrate that a patient's blood glucose has been well controlled over the long term. Accordingly, self-management assessment should be combined with HbA1c measurement and evaluation of diabetes complications to provide a more comprehensive clinical picture. Respondent characteristics may also have contributed to the high proportion of suspected DPN. Most participants had had diabetes for 5–10 years (65.5%), while 34.5% had had the disease for more than 10 years. Chronic hyperglycemia and longer disease duration may contribute to cumulative peripheral nerve damage. Persistent hyperglycemia can promote the formation of ROS and AGEs, activate the polyol pathway, and cause microvascular dysfunction, all of which may contribute to the development of diabetic neuropathy. Thus, self-management behavior assessed at the time of the study may not reflect patients' glycemic control over the years preceding the onset of neuropathy symptoms.

The characteristics of the instrument used to assess DPN should also be considered. This study used the Indonesian version of the DNS, which assesses neuropathy symptoms based on respondents' reports. Therefore, a positive result indicates suspected DPN based on symptoms; it does not constitute a confirmed diagnosis established through a neurological examination or nerve conduction testing. Symptom-based instruments facilitate data collection in community populations but have limitations in confirming a clinical diagnosis and distinguishing diabetic neuropathy symptoms from those caused by other conditions. Furthermore, the cross-sectional design meant that self-management behavior and suspected DPN were assessed during the same period. The study cannot establish whether good self-management was practiced before neuropathy developed or was adopted only after the patient experienced complications. Patients who have neuropathy symptoms may, in fact, improve their self-care practices after receiving education or healthcare services. This possibility makes the association between self-management behavior and neuropathy status more difficult to interpret.

Overall, the findings indicate that questionnaire-based self-management categories alone are insufficient to describe glycemic control and neuropathy status in patients with T2DM. Patient assessments should also consider HbA1c levels, duration of diabetes, treatment history, and clinical evaluation for neuropathy. Further studies with larger samples, repeated assessments of self-management, and clinical and neurological confirmation of DPN are needed to clarify the relationship between self-management behavior, glycemic control, and diabetic peripheral neuropathy.

CONCLUSION

No significant association was found between self-management behavior and suspected DPN among patients with T2DM in Sumbang District, Banyumas. Poor HbA1c control may be an important factor associated with suspected DPN, highlighting the need to develop strategies for achieving effective blood glucose control.

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