

Ipswich Touch Test as a Screening Tool for Diabetic Sensory Neuropathy Based on the Duration of Type 2 Diabetes Mellitus

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ABSTRACT

Type 2 diabetes mellitus (T2DM) is a chronic disease that can lead to diabetic sensory neuropathy (DSN), increasing the risk of foot ulcers and amputation. This study aimed to analyze the relationship between the duration of T2DM and diabetic sensory neuropathy screening results. A quantitative correlational study with a cross-sectional design was conducted among 40 patients with T2DM selected through consecutive sampling from 51 eligible patients. T2DM duration was obtained through structured interviews and/or medical records, whereas DSN was assessed using the Ipswich Touch Test (IpTT). Spearman's rho correlation test showed a significant relationship between the duration of T2DM and DSN ($p = 0.003$; $r = 0.455$). A longer duration of T2DM was associated with a higher likelihood of diabetic sensory neuropathy. The IpTT may serve as a simple screening method for diabetic sensory neuropathy in primary healthcare settings.

Keywords: *Duration of Type 2 Diabetes Mellitus; Diabetic Sensory Neuropathy; Ipswich Touch Test*

INTRODUCTION

Type 2 diabetes mellitus (T2DM) is one of the most prevalent non-communicable diseases, with a continuously increasing prevalence that poses a major challenge to healthcare services. Chronic hyperglycemia in T2DM can lead to various microvascular complications, one of which is diabetic sensory neuropathy (DSN) (Sriyati, 2024). This complication is characterized by the loss of protective sensation in the feet, which increases the risk of diabetic foot ulcers, infection, amputation, and reduced quality of life (Sulistiani et al., 2022). The World Health Organization (2023), reported that more than 422 million people worldwide are living with diabetes, with approximately 1.5 million deaths occurring annually due to this disease. In Indonesia, the prevalence of diabetes mellitus among individuals aged ≥ 15 years is 11.7%, highlighting the importance of early detection of complications as an integral component of T2DM management to prevent disability and improve patients' quality of life.

The duration of type 2 diabetes mellitus (T2DM) is one of the factors associated with the development of diabetic sensory neuropathy (DSN). Prolonged hyperglycemia induces the formation of advanced glycation end products (AGEs), increases oxidative stress, impairs microcirculation, and causes progressive peripheral nerve damage (Dahrizal et al., 2023; Singh et al., 2025). Several studies have reported that patients with a longer duration of T2DM are at a higher risk of developing diabetic sensory neuropathy than those with a shorter disease duration (Nasibu & Priasmoro, 2025; Rahmi et al., 2022; Raminda et al., 2024). These findings suggest that disease duration is an important indicator for determining the need for regular neuropathy screening.

Previous studies have used various methods to assess diabetic sensory neuropathy (DSN), including the Michigan Neuropathy Screening Instrument (MNSI), Neuropathy Disability Score (NDS), the 10-g monofilament test, the Ipswich Touch Test (IpTT), and

nerve conduction studies (NCS/NCV). These instruments differ in their feasibility and applicability across healthcare settings. Nasibu and Priasmoro (2025) used an observation checklist but did not provide a detailed description of the screening instrument. Raminda et al. (2024) employed the Ipswich Touch Test (IpTT); however, the study included only female participants, limiting the generalizability of the findings to the broader population of patients with T2DM. Rahmi et al. (2022) used nerve conduction studies, which require specialized equipment and relatively high examination costs, thereby limiting their implementation in primary healthcare settings. These findings highlight the need for studies using a simple screening method in a more diverse population of patients with T2DM.

This study contributes by evaluating the relationship between the duration of type 2 diabetes mellitus and the screening results for diabetic sensory neuropathy using the Ipswich Touch Test (IpTT) among patients with type 2 diabetes mellitus in primary healthcare settings. The use of the IpTT as a simple, practical screening method that does not require specialized equipment is expected to strengthen the implementation of early detection of diabetic sensory neuropathy in nursing practice and serve as a basis for the development of routine screening within diabetes management programs.

Based on the foregoing, this study aimed to analyze the relationship between the duration of type 2 diabetes mellitus and the screening results for diabetic sensory neuropathy using the Ipswich Touch Test (IpTT) among patients with type 2 diabetes mellitus.

METHOD

This study employed a quantitative research design with a correlational analytic approach using a cross-sectional design to analyze the relationship between the duration of type 2 diabetes mellitus and diabetic sensory neuropathy (DSN). The study was conducted at the Dlanggu Public Health Center, Mojokerto Regency, East Java, Indonesia, from April 17 to April 23, 2026.

The study population consisted of 51 patients with type 2 diabetes mellitus (T2DM) who were actively enrolled in the Chronic Disease Management Program (Prolanis). The sample was selected using a consecutive sampling technique based on the inclusion and exclusion criteria, resulting in a total of 40 participants. The inclusion criteria were patients with type 2 diabetes mellitus who were willing to participate in the study and able to communicate effectively. The exclusion criteria included patients with impaired consciousness, those who did not attend the Prolanis program activities, and those with foot wounds or a history of amputation at one or all examination sites on the feet.

This study received ethical approval from the Research Ethics Committee of the Institute for Research and Community Service, Universitas Bina Sehat PPNI Mojokerto, under approval number 48/KEP/UBS-PPNI/II/2026. All participants were provided with information regarding the objectives and procedures of the study and signed a written informed consent form before participating in the study.

The duration of type 2 diabetes mellitus (T2DM) was obtained through interviews and verified using medical records when participants were unable to recall or confirm the duration of their diabetes. Diabetic sensory neuropathy (DSN) was assessed using the Ipswich Touch Test (IpTT) according to the standard operating procedure (SOP). The examination was performed at six designated sites on both feet. Participants were instructed to close their eyes, after which the examiner gently touched each site with the tip of a finger

for 1–2 seconds. A score of 0 was assigned if the participant was able to perceive the touch, whereas a score of 1 was assigned if the participant was unable to perceive the touch. A total score of ≥ 2 was classified as loss of protective sensation (LOPS), whereas a score of < 2 was classified as no loss of protective sensation.

Data were analyzed using IBM SPSS Statistics version 21. Descriptive analysis was performed to summarize the characteristics of the participants and the distribution of the study variables. The relationship between the duration of type 2 diabetes mellitus and diabetic sensory neuropathy was analyzed using Spearman's rho correlation test at a significance level of $p < 0.05$ because both variables were measured on an ordinal scale and did not meet the assumptions for parametric correlation analysis.

FINDING AND DISCUSSION

RESEARCH RESULT

Table 1 Characteristics of the Participants

Characteristics	Frequency (n)	Percentage (%)
Age		
<60 years	26	65
≥ 60 years	14	35
Total	40	100
Sex		
Male	4	10
Female	36	90
Total	40	100
Educational Level		
No formal education	2	5
Primary school (SD/MI)	13	32.5
Junior high school (SMP/MTs)	11	27.5
Senior high school (SMA)	13	32.5
Higher education	1	2.5
Total	40	100
History of Hypertension		
Yes	18	45
No	22	55
Total	40	100

The characteristics of the participants are presented in Table 1. The majority of the participants were aged <60 years (26 participants, 65%) and were female (36 participants, 90%). Based on educational level, most participants had completed primary school (SD/MI) or senior high school, with 13 participants (32.5%) in each category. The majority of the participants had no history of hypertension (22 participants, 55%).

Table 2 Distribution of the Duration of Type 2 Diabetes Mellitus

<i>Duration of T2DM</i>	Frequency (n)	Percentage (%)
<5 years	20	50
≥5 years	20	50
Total	40	100

The distribution of the duration of type 2 diabetes mellitus is presented in Table 2. Participants with a duration of type 2 diabetes mellitus of <5 years and ≥5 years were equally represented, with 20 participants (50.0%) in each group.

Table 3 Distribution of Diabetic Sensory Neuropathy

Diabetic Sensory Neuropathy	Frequency (n)	Percentage (%)
LOPS (-)	17	42.5
LOPS (+)	23	57.5
Total	40	100

The distribution of diabetic sensory neuropathy is presented in Table 3. The majority of the participants had diabetic sensory neuropathy (LOPS (+)), accounting for 23 participants (57.5%), whereas 17 participants (42.5%) did not have diabetic sensory neuropathy (LOPS (-)).

Table 4 Relationship between the Duration of Type 2 Diabetes Mellitus and Diabetic Sensory Neuropathy

<i>Duration of T2DM</i>	Diabetic Sensory Neuropathy				Total	
	LOPS (-)		LOPS (+)			
	n	%	n	%	n	%
<5 tahun	13	65	7	35	20	100
≥5 tahun	4	20	16	80	20	100
Total	17	42,5	23	57,5	40	100
Statistical Test Results	p : 0.003		α : < 0.05		r : 0.455**	

The results of Spearman's rho test demonstrated a significant relationship between the duration of type 2 diabetes mellitus and diabetic sensory neuropathy ($p = 0.003$). The correlation coefficient ($r = 0.455$) indicated a moderate positive correlation.

DISCUSSION

The results of this study demonstrated a significant relationship between the duration of type 2 diabetes mellitus and diabetic sensory neuropathy among patients with type 2 diabetes mellitus, with a p -value of 0.003 and a correlation coefficient (r) of 0.455. These findings indicate that the longer the duration of T2DM, the greater the likelihood of developing diabetic sensory neuropathy. This relationship may be explained by prolonged exposure to chronic hyperglycemia, which promotes the formation of advanced glycation end products (AGEs), increases oxidative stress, impairs microcirculation, and causes progressive peripheral nerve damage. These pathological processes result in a reduction or

loss of protective sensation (LOPS), thereby increasing the risk of foot injury, diabetic foot ulcers, infection, and amputation (Dahrizal et al., 2023; Roy, 2025). The moderate correlation coefficient also indicates that the duration of T2DM is one of the factors associated with the development of diabetic sensory neuropathy, although it is not the only factor contributing to this condition. These findings emphasize the important role of nurses in the early detection of diabetic sensory neuropathy through regular foot sensation assessments as part of nursing care for patients with T2DM, thereby helping to prevent diabetic foot complications at an early stage.

The findings of this study are consistent with those reported by Nasibu and Priasmoro (2025), Rahmi et al. (2022), and Raminda et al. (2024), who found that patients with a longer duration of T2DM were at a higher risk of developing diabetic sensory neuropathy. In the present study, the majority of participants with a T2DM duration of ≥ 5 years experienced LOPS (+) (80%). Nevertheless, participants with a T2DM duration of < 5 years who had already experienced LOPS (+) and participants with a T2DM duration of ≥ 5 years who had not experienced LOPS were still identified. These findings indicate that diabetic sensory neuropathy is a multifactorial complication and is not solely influenced by the duration of type 2 diabetes mellitus (Henky & Tusaddiyah, 2025; Widiанти et al., 2024). In this study, all participants with a T2DM duration of < 5 years who experienced LOPS (+) were female, whereas most participants with a T2DM duration of ≥ 5 years who did not experience LOPS (–) were aged < 60 years and had a moderate to high level of education. These findings indicate that factors such as sex, age, educational level, comorbidities, and glycemic control may also influence the development of diabetic sensory neuropathy. However, a longer duration of type 2 diabetes mellitus remains associated with an increased risk of neuropathy due to continuous exposure to chronic hyperglycemia. Pathophysiologically, chronic hyperglycemia leads to the accumulation of advanced glycation end products (AGEs), increased oxidative stress, and impaired microcirculation, resulting in peripheral nerve damage and loss of sensory function (loss of protective sensation [LOPS]) (Singh et al., 2025). Therefore, although diabetic sensory neuropathy is influenced by multiple factors, the duration of type 2 diabetes mellitus remains an important factor contributing to an increased risk of diabetic sensory neuropathy.

This study has several limitations that should be considered. Data collection was conducted concurrently with the Prolanis (Chronic Disease Management Program) activities, which were attended by patients with type 2 diabetes mellitus and hypertension in the same room, resulting in a less conducive environment for data collection. The data collection process also took place simultaneously with routine health examinations and other students' research activities, requiring some participants to wait for their turn to be examined, which may have affected their comfort and concentration during the data collection process. In addition, the limited number of personnel responsible for the Prolanis program resulted in suboptimal participant management during the implementation of the study.

The findings of this study suggest that the Ipswich Touch Test (IpTT) has the potential to be implemented as a screening method for diabetic sensory neuropathy in primary healthcare settings because it is simple, practical, does not require specialized equipment, and can be easily integrated into the Prolanis (Chronic Disease Management Program) and routine nursing services. Future studies are recommended to conduct data collection under more conducive conditions and not concurrently with routine healthcare services or other

research activities, thereby allowing the examination process to be carried out more effectively. In addition, future research should consider other factors that may influence diabetic sensory neuropathy, such as glycemic control, HbA1c levels, physical activity, occupation, and comorbidities, to provide a more comprehensive understanding of the factors associated with diabetic sensory neuropathy.

CONCLUSION

A significant relationship was found between the duration of type 2 diabetes mellitus and diabetic sensory neuropathy among patients with T2DM at the Dlanggu Public Health Center, Mojokerto. Patients with a longer duration of T2DM were more likely to experience loss of protective sensation (LOPS). These findings suggest that the Ipswich Touch Test (IpTT) may be considered a practical screening method for diabetic sensory neuropathy in primary healthcare settings to support early detection and the prevention of diabetic foot complications.

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