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THE RELATIONSHIP BETWEEN PERIPHERAL OXYGEN SATURATION (SPO_2), ANKLE-BRACHIAL INDEX (ABI), AND HBA1C LEVELS WITH DIABETIC NEUROPATHY

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ABSTRACT
Diabetic neuropathy is one of the most common chronic complications in patients with type 2 diabetes mellitus and may lead to foot ulcers and amputation. Peripheral circulation disorders, tissue oxygenation impairment, and poor glycemic control are considered contributing factors. To determine the relationship between oxygen saturation (SpO_2), Ankle–Brachial Index (ABI), and HbA1c levels with diabetic neuropathy among patients with type 2 diabetes mellitus. A quantitative descriptive-analytic cross-sectional study was conducted among 60 patients with type 2 diabetes mellitus at Lantana Medika Clinic, South Jakarta. Participants were recruited using consecutive sampling based on predefined inclusion and exclusion criteria. Data were collected through face-to-face interviews, structured questionnaires, direct clinical assessments, and medical record review. SpO_2 was measured using a pulse oximeter, ABI was determined using a sphygmomanometer and handheld Doppler device, and HbA1c values were obtained from the participants' most recent laboratory results. Diabetic neuropathy was assessed using the Comprehensive Diabetic Neuropathy Screening Algorithm (CDNSA). Data were analyzed using descriptive statistics, Chi-square tests, and binary logistic regression. There was a significant relationship between duration of diabetes and HbA1c levels with diabetic neuropathy ($p < 0.05$). Multivariate analysis identified HbA1c as the most dominant factor associated with diabetic neuropathy. HbA1c and duration of diabetes are significantly associated with diabetic neuropathy. A comprehensive screening approach incorporating tissue oxygenation, peripheral circulation, and glycemic control assessment may enhance the early detection of diabetic neuropathy in primary healthcare settings.

Keywords: ankle brachial index; diabetes mellitus; diabetic neuropathy; HbA1c; oxygen saturation

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INTRODUCTION

Diabetes mellitus is a group of metabolic disorders characterized by persistent hyperglycemia resulting from defects in insulin secretion, insulin action, or both (American Diabetes Association [ADA], 2025). Patients with diabetes are encouraged to maintain optimal glycemic control to prevent the development of diabetic neuropathy and other chronic complications (Pamungkas & Usman, 2021). Diabetes-related complications may be acute or chronic. Chronic complications involve both macrovascular and microvascular damage, including diabetic neuropathy (Islam et al., 2025). Diabetic neuropathy is a disorder characterized by damage to sensory neurons, resulting in neuropathic pain involving both the central and peripheral nervous systems with varying clinical manifestations, such as pain and numbness. Clinically, the most common presentation is distal symmetric polyneuropathy affecting the feet and hands, with symptom severity progressing from distal to proximal regions (Pang et al., 2020).

In Indonesia, the prevalence of diabetes mellitus continues to increase. The 2018 National Basic Health Research (Riskesdas) reported that the prevalence of diabetes increased from 6.9% in 2013 to 10.9% in 2018, with a similar trend observed in West Java. This growing prevalence has been accompanied by an increase in chronic complications, particularly diabetic neuropathy. Clinical data from Dr. Cipto Mangunkusumo National Central General Hospital (RSCM) showed that

diabetic neuropathy was present in approximately 54% of patients with diabetes, exceeding the prevalence of retinopathy (33.4%), proteinuria (26.5%), and peripheral arterial disease (10.9%). Similarly, at M. Soewandhie Regional General Hospital, Surabaya, 71.9% of patients with type 2 diabetes mellitus experienced diabetic neuropathy. The World Health Organization (WHO, 2020) recognizes chronic complications such as diabetic neuropathy as a major cause of disability and reduced quality of life among individuals with diabetes in developing countries, including Indonesia. Therefore, greater attention should be directed toward prevention, early detection, and comprehensive management of diabetic neuropathy (Ministry of Health of the Republic of Indonesia, 2018; Dr. Cipto Mangunkusumo National Central General Hospital, 2018; M. Soewandhie Regional General Hospital, 2016; WHO, 2020).

The pathogenesis of diabetic neuropathy is primarily driven by chronic hyperglycemia, which triggers multiple metabolic and vascular abnormalities. Excess intracellular glucose enters the polyol pathway, leading to sorbitol accumulation and depletion of intracellular antioxidants. Simultaneously, the formation of advanced glycation end products (AGEs) and increased production of reactive oxygen species promote oxidative stress and chronic inflammation. In addition, microvascular dysfunction reduces blood flow to peripheral nerves, resulting in neural ischemia. The combined effects of metabolic and vascular disturbances contribute to axonal degeneration and demyelination, ultimately leading to clinical manifestations such as tingling, burning pain, numbness, and diabetic foot ulcers (Zhu et al., 2024). Early detection of diabetic neuropathy is essential for reducing morbidity associated with peripheral neuropathy. Timely diagnosis and appropriate management of diabetes, together with the identification and control of neuropathy risk factors, can prevent, delay, or slow the progression of diabetic neuropathy. Therefore, there is a need for a simple, practical, and reliable screening instrument that can be implemented in healthcare settings with limited diagnostic facilities.

The Comprehensive Diabetic Neuropathy Screening Algorithm (CDNSA) was developed as a screening instrument for diabetic neuropathy in patients with type 2 diabetes mellitus by incorporating direct assessments of both small and large nerve fibers, which play essential roles in the development of diabetic neuropathy. Evaluation studies have demonstrated that the CDNSA possesses good sensitivity, specificity, and diagnostic accuracy, as reflected by a favorable area under the receiver operating characteristic curve (AUC). These findings indicate that the CDNSA is a valid and reliable instrument for screening diabetic neuropathy (Widiatmika, 2015).

Based on this background, this study aimed to examine the association between peripheral oxygen saturation (SpO_2), Ankle–Brachial Index (ABI), and HbA1c levels and diabetic neuropathy as assessed using the Comprehensive Diabetic Neuropathy Screening Algorithm (CDNSA) among patients with type 2 diabetes mellitus at Lantana Medika Clinic, South Jakarta. The findings of this study are expected to provide scientific evidence regarding factors associated with diabetic neuropathy and to support the implementation of comprehensive screening strategies for early detection, prevention of complications, and evidence-based nursing practice in the management of patients with type 2 diabetes mellitus.

METHOD

This study employed a quantitative approach using a descriptive-analytic cross-sectional design. The study was conducted to examine the associations between peripheral oxygen saturation (SpO_2), Ankle–Brachial Index (ABI), and glycated hemoglobin (HbA1c) levels as independent variables and diabetic neuropathy as the dependent variable at a single point in time without follow-up (Polit & Beck, 2021; Creswell, 2023). The research was carried out at Lantana Medika Clinic, South Jakarta, from July to August 2025. The study population consisted of all patients diagnosed with type 2 diabetes mellitus (T2DM) receiving treatment at Lantana Medika Clinic. Participants were recruited based on predefined inclusion and exclusion criteria. The required sample size was calculated using G*Power software with an assumed medium effect size ($d = 0.50$), a significance level of $\alpha = 0.05$, and a statistical power ($1 - \beta$) of 0.80, yielding a minimum sample size of 54

participants. To account for potential dropouts or incomplete data, the sample size was increased by 10%, resulting in a target sample of 60 participants. A consecutive sampling technique was applied, whereby all eligible patients who met the inclusion criteria and did not meet the exclusion criteria were recruited consecutively until the required sample size was achieved.

Data were collected from both primary and secondary sources. Primary data were obtained through face-to-face interviews, a structured questionnaire assessing participants' demographic and clinical characteristics, and direct clinical assessments. Peripheral oxygen saturation (SpO_2) was measured using a pulse oximeter, while the Ankle–Brachial Index (ABI) was determined using a sphygmomanometer and a handheld Doppler device. HbA1c values were obtained from the participants' most recent laboratory test results. Diabetic neuropathy was assessed using the Comprehensive Diabetic Neuropathy Screening Algorithm (CDNSA), a validated screening instrument designed to evaluate both small- and large-fiber neuropathy. Secondary data, including relevant clinical information, were obtained from patients' medical records and supporting scientific literature.

Following data collection, all data underwent editing, coding, sorting, data entry, cleaning, and tabulation before statistical analysis. Statistical analyses were performed using IBM SPSS Statistics. Descriptive (univariate) analysis was conducted to summarize participants' characteristics and study variables using means, standard deviations, frequencies, and percentages, as appropriate. Data normality was assessed using the Kolmogorov–Smirnov or Shapiro–Wilk test, depending on the sample size and data distribution. Bivariate analysis was performed using the Chi-square test to examine the associations between SpO_2, ABI, HbA1c levels, and diabetic neuropathy, with statistical significance set at $p < 0.05$. Subsequently, binary logistic regression analysis was conducted to identify independent factors associated with diabetic neuropathy after controlling for potential confounding variables, including age, sex, duration of diabetes, treatment adherence, and physical activity.

RESULT

Table 1
Respondent Characteristics Based on (Numerical Data) Age and Length of Suffering (n=60)

Variables	Mean	Median	Elementary School	Min- Max
Age	52.58	53.00	7,226	34-67
Long Suffering	3.87	4.00	.833	2-6

Table 1, it shows that the average age of respondents is 52.58 years with a standard deviation of 7.226, the youngest age is 34 years and the oldest age is 67 years, with a median value of 53.00 years. Meanwhile, the average length of time the respondents suffered from the disease was 3.87 years with a standard deviation of 0.833, the shortest length of time was 2 years and the longest was 6 years, with a median value of 4.00 years.

Table 2, the majority of respondents were female, accounting for 39 respondents (65.0%), while 21 respondents (35.0%) were male. Regarding complaints, most respondents reported no neuropathic complaints (42 respondents; 70.0%), whereas 18 respondents (30.0%) reported neuropathic complaints. In terms of therapy compliance, the majority of respondents were non-compliant with therapy (40 respondents; 66.7%), while 20 respondents (33.3%) were compliant. Based on activity level, most respondents had light physical activity (38 respondents; 63.3%), whereas 22 respondents (36.7%) had moderate activity. Regarding oxygen saturation (SpO_2), the majority of respondents had normal SpO_2 levels (53 respondents; 88.3%), while 7 respondents (11.7%) had low SpO_2 levels. Based on the Ankle Brachial Index (ABI), most respondents were classified in the mild impairment category (31 respondents; 51.7%), followed by the normal category (27 respondents; 45.0%) and severe impairment category (2 respondents; 3.3%). Based on HbA1c levels, the majority of respondents were classified in the diabetes category (52 respondents; 86.7%), while 8 respondents (13.3%) were classified as having prediabetes. Finally,

based on CDNSA screening results, most respondents were classified as having no neuropathy (37 respondents; 61.7%), whereas 23 respondents (38.3%) were classified as having neuropathy.

Table 2
Respondent Characteristics Based on (Categorical Data) Gender, Complaints, Therapy Compliance, Activity, SpO2 ABI (Brachial Ankle Index) HbA1c and CDNSA (n=60)

Characteristics	f	%
Gender		
Man	21	35.0
Woman	39	65.0
Complaint		
Not Neuropathy	42	70.0
Neuropathy	18	30.0
Therapy Compliance		
Not obey	40	66.7
Obedient	20	33.3
Activity		
Light	38	63.3
Currently	22	36.7
SpO2		
Normal	53	88.3
Low	7	11.7
ABI		
Normal	27	45.0
Light	31	51.7
Heavy	2	3.3
HbA1c		
Prediabetes	8	13.3
Diabetes	52	86.7
CDNSA		
Neuropathy	23	38.3
No Neuropathy	37	61.7

Table 3.
Bivariate Test Results of the Relationship between SpO_2, ABI, and HbA1c and the Incidence of Neuropathy Diabetic (CDNSA) (n=64)

Variables	Categorical	Neuropathy f (%)	No Neuropathy f (%)	p-value	OR 95%Cl
SpO_2	Normal	16 (26.7)	37 (61.7)	0,000	0,000
	Low	7 (11.7)	0 (0.0)		
ABI	Normal	7 (11.7)	20 (33.3)	0.039	498,431
	Light	15 (25.0)	16 (26.7)		
	Heavy	1 (1.7)	1 (1.7)		
HbA1c	Prediabetes	1 (1.7)	7 (11.7)	0.023	31,282
	Diabetes	22 (36.7)	30 (50.0)		

Table 3, the results of the bivariate analysis, the SpO_2, ABI, and HbA1c variables showed a statistically significant relationship with the incidence of diabetic neuropathy ($p < 0.05$). In the SpO_2 variable, all respondents with low SpO_2 levels experienced diabetic neuropathy (11.7%), and there were no respondents without neuropathy in this category. Conversely, in those with normal SpO_2, 26.7% experienced neuropathy and 61.7% did not experience neuropathy. A p-value of 0.000 indicates a highly significant relationship. However, an OR value of 0.000 indicates the presence of a zero-value cell, making the risk estimate unstable and less statistically accurate to interpret. This condition is called complete separation. For the ABI variable, a p-value of 0.039 was obtained, indicating a significant association between ABI and the incidence of diabetic neuropathy. The OR of 498.431 indicates that patients with an abnormal ABI category have a significantly greater chance of developing neuropathy than those in the reference group. However, a very large OR value indicates an imbalance in the data distribution or a small sample size, resulting in an extremely extreme risk estimate. For the HbA1c variable, a p-value of 0.023 was obtained, indicating a significant association between HbA1c levels and diabetic neuropathy. The OR of 31.282 indicates that patients with HbA1c levels in the diabetes category have a significantly higher chance of developing neuropathy than those in the prediabetes category. However, this very

large OR also indicates the possibility of an imbalanced data distribution or low frequency in one category.

Table 4.
Bivariate Selection Results of Independent Variables against Dependent Variables (n=64)

Variables	p-value
HbA1c	0.023
SpO_2	0,000
Age	0.038
Activity	0.016
Long Suffering	0.001
Gender	0.892
Therapy Compliance	0.171
ABI	0.492
Complaint	0.260

Table 4. The results of the analysis show that the variables HbA1c ($p = 0.023$), SpO_2 ($p = 0.000$), age ($p = 0.038$), activity ($p = 0.016$), and duration of illness ($p = 0.001$) have a p value < 0.25, thus meeting the bivariate selection criteria and being included in the multivariate logistic regression analysis. Meanwhile, the variables gender ($p = 0.892$), ABI ($p = 0.492$), and complaints ($p = 0.260$) did not meet the bivariate selection criteria and were not included in the multivariate analysis. The variable therapy adherence ($p = 0.171$), although not significant at $p < 0.05$, still met the bivariate selection criteria ($p < 0.25$) and was therefore considered in the multivariate model.

Table 5.
Results of further bivariate independent selection of the dependent variable (n = 60)

Variables	p-value
HbA1c	0.023
SpO_2	0,000
Age	0.038
Activity	0.016
Long Suffering	0.001

Based on the analysis results, the HbA1c variable has a significance value of $p = 0.023$, indicating that HbA1c has a statistically significant relationship with the dependent variable and meets the bivariate selection criteria. The SpO_2 variable shows a significance value of $p = 0.000$, meaning that SpO_2 has a statistically significant relationship with the dependent variable and is a strong candidate variable in the multivariate analysis. The age variable has a significance value of $p = 0.038$, so it can be concluded that age has a significant relationship with the dependent variable and meets the bivariate selection criteria. The activity variable also shows a significance value of $p = 0.016$, meaning that activity is significantly related to the dependent variable and is worthy of inclusion in the multivariate model. In addition, the duration of illness variable has a significance value of $p = 0.001$, indicating that the duration of illness has a very significant relationship with the dependent variable and meets the bivariate selection criteria.

Table 6.
Interpretation of Multivariate Modeling of Influential Range OR (Odds Ratio) Against Diabetic Neuropathy (n=60)

Variables	B	Wald	P value	OR 95%Cl
Age	0.222	1,821	0.177	1.248 (0.901 – 1.728)
Long Suffering	2,661	5,499	0.019	14,317 (1,570 – 130,500)
Gender	-0.284	0.073	0.787	0.753 (0.110 – 5.150)
Therapy Compliance	2,578	1,221	0.270	13,170 (0.201 – 861,400)
Activity	-0.706	0.179	0.672	0.494 (0.032 – 7.650)
ABI	-0.072	0.011	0.915	0.931 (0.247 – 3.510)
HbA1c	3,553	5,823	0.016	34,935 (2,030 – 601,200)
Constant	-27,110	6,874	0.009	0,000

Based on the results of the multivariate logistic regression analysis, it was found that not all variables included in the model had a significant relationship with the incidence of diabetic neuropathy. Of the seven variables analyzed, only duration of diabetes mellitus and HbA1c showed a statistically significant effect on the incidence of diabetic neuropathy ($p < 0.05$). The variable duration of diabetes mellitus has a p-value of 0.019 with an OR of 14.317 and a 95% CI of 1.570–

130.500. This indicates that patients who have had diabetes for a longer period have approximately a 14-fold greater risk of developing diabetic neuropathy compared to patients with a shorter duration of the disease. Because the confidence interval value does not exceed 1, this relationship is considered statistically significant. These findings indicate that disease duration is an important risk factor for the development of neuropathic complications.

The HbA1c variable also showed a significant association with the incidence of diabetic neuropathy, with a p-value of 0.016 and an OR of 34.935 and a 95% CI of 2.030–601.200. This means that patients with high HbA1c levels have approximately a 34-fold greater risk of developing diabetic neuropathy compared to patients with lower HbA1c levels. The confidence interval range that does not exceed 1 confirms that this variable is significant and is the most dominant factor in the model. Meanwhile, the variables of age (p = 0.177; OR = 1.248; 95% CI: 0.901–1.728), gender (p = 0.787; OR = 0.753; 95% CI: 0.110–5.150), therapy adherence (p = 0.270; OR = 13.170; 95% CI: 0.201–861.400), activity (p = 0.672; OR = 0.494; 95% CI: 0.032–7.650), and ABI (p = 0.915; OR = 0.931; 95% CI: 0.247–3.510) did not show a statistically significant relationship because the p value > 0.05 and the confidence interval range exceeded 1. Thus, in this model these variables have not been can be said to have an effect on the incidence of diabetic neuropathy.

Table 7.
Multivariate Interpretation of Range OR Advanced Stage of Influential Variables on Diabetic Neuropathy (n=60

Variables	Phase I		Phase II		Phase III		Stage IV	
	P Value	OR	P Value	OR	P Value	OR	P Value	OR
Age	0.177	1,248	0.177	1,246	0.190	1,238	0.150	1,259
OR Change			ΔOR 0.16%					ΔOR 0.88%
Long Suffering	0.019	14,317	0.017	13,922	0.017	13,610	0.011*	15,030
OR Change			ΔOR 2.76%		ΔOR 2.24%			ΔOR 10.43%
Gender	0.787	0.753	0.796	0.766	0	0	0	0
OR Change			ΔOR 1.73%		ΔOR 0%			ΔOR 0%
Therapy Compliance	0.270	13,170	0.269	13,201	0.261	10,098	0.287	7,528
OR Change			ΔOR 0.24%		ΔOR 23.49%			ΔOR 25.46%
Activity	0.672	0.494	0.668	0.488	0.708	0.552	0	0
OR Change			ΔOR 1.21%		ΔOR 13.11%			ΔOR 0%
ABI	0.915	0.931	0	0	0	0	0	0
OR Change			ΔOR 0%		ΔOR 0%			ΔOR 0%
HbA1c	0.016	34,935	0.016	34,673	0.014	31,830	0.012*	33,112
OR Change			ΔOR 0.75%		ΔOR 8.20%			ΔOR 4.03%

Description: 0 = Removed from moderation, * = re-entered. Based on table 7, the results of multivariate modeling in the table show that from Stage I to Stage IV, a gradual variable selection process was carried out using the elimination method, taking into account the statistical significance value (p-value) and the odds ratio change criteria (ΔOR ≥10%) as an indicator of the presence of confounding effects. In Phase I, all independent variables were entered into the analysis model. The results showed that duration of disease (p=0.019; OR=14.317) and HbA1c (p=0.016; OR=34.935) had a statistically significant association with the incidence of diabetic neuropathy. Meanwhile, age, gender, therapy adherence, physical activity, and ABI did not show a significant association (p>0.05). In Phase II, after eliminating the variables with the smallest contribution, the change in OR values for several variables was relatively minimal (<10%), such as age (ΔOR 0.16%) and duration of illness (ΔOR 2.76%). This condition indicates that the eliminated variables do not act as significant confounders in the model. The Stage III and Stage IV treatment adherence variables showed a 23.49% change in OR, increasing to 25.46%. Although the OR change exceeded 10%, the statistical significance value remained insignificant (p=0.287), so this variable was not retained in the final model.The duration of disease variable showed a 10.43% change in the OR in Stage IV, with the OR increasing to 15.030 (p=0.011). These findings indicate that duration of disease is a consistent risk factor and a strong contributor to the incidence of diabetic neuropathy.

Table 8.
Results of the Final Multivariate Modeling Analysis of Variables Influencing Diabetic Neuropathy (n=60)

Variables	B	Walid	P	Exp(B)	95%CI	
					Min	Max
Long_Suffering	2,846	7,363	0.007	17,220	2,204	134,524
HbA1c	3,125	5,973	0.015	22,755	1,857	278,890
Constant	-14,192	7,261	0.007	0,000	-	-

The duration of diabetes variable has a B value of 2.846 with a Wald of 7.363 and p = 0.007. The Exp(B) value is 17.220 with a 95% CI of 2.204–134.524. This indicates that respondents with a longer duration of diabetes have a 17.220 times greater risk of developing diabetic neuropathy than respondents with a shorter duration. The confidence interval does not exceed 1, so the relationship is statistically significant. The HbA1c variable has a B value of 3.125 with a Wald of 5.973 and p = 0.015. The Exp(B) value is 22.755 with a 95% CI of 1.857–278.890. This means that respondents with uncontrolled HbA1c levels have a 22.755 times greater risk of developing diabetic neuropathy compared to respondents with controlled HbA1c. The confidence interval, which also does not cross 1, confirms that HbA1c is a significant risk factor. Comparatively, the most dominant variable in the final model is HbA1c, as it has the largest Exp(B) value (22.755). The constant value of -14.192 indicates that without the contribution of the duration of illness and HbA1c variables, the probability of diabetic neuropathy is very small. Mathematically, the resulting logistic regression model can be formulated as: Z = -14.192 + 2.846 (Duration of illness) + 3.125 (HbA1c)

DISCUSSION

Diabetic neuropathy is one of the chronic complications of diabetes mellitus that develops through the interaction of metabolic and vascular disorders. This study demonstrated that peripheral oxygen saturation (SpO_2), the Ankle Brachial Index (ABI), and HbA1c levels were significantly associated with diabetic neuropathy. These findings indicate that peripheral nerve damage is influenced not only by chronic hyperglycemia but also by impaired tissue perfusion and oxygenation. The combination of these factors promotes progressive nerve injury through oxidative stress, endothelial dysfunction, and microcirculatory impairment, ultimately leading to decreased peripheral nerve function (Zhu et al., 2024). The characteristics of the respondents showed that most patients had experienced diabetes for a relatively long duration, with suboptimal treatment adherence and low levels of physical activity. These conditions increase exposure to chronic hyperglycemia, which activates the polyol pathway, promotes the formation of advanced glycation end products (AGEs), induces oxidative stress, and causes vascular damage, thereby accelerating axonal degeneration and peripheral nerve demyelination. These findings emphasize the importance of early risk factor control to prevent the progression of diabetic neuropathy (Pang et al., 2020).

This study also demonstrated significant associations between SpO_2, ABI, and diabetic neuropathy. Reduced oxygen saturation reflects decreased oxygen delivery to peripheral tissues, whereas a low ABI indicates impaired peripheral perfusion due to peripheral arterial disease. Both conditions contribute to tissue hypoxia, disrupted neuronal metabolism, and reduced nutrient supply, thereby accelerating peripheral nerve damage. These findings confirm that vascular mechanisms play a critical role in the pathogenesis of diabetic neuropathy in addition to metabolic disturbances (Islam et al., 2025). Among the variables examined, HbA1c was the strongest factor associated with diabetic neuropathy. HbA1c reflects the average blood glucose level over the previous two to three months and is considered the most reliable indicator of chronic hyperglycemic exposure. Higher HbA1c levels increase the risk of AGE formation, endothelial dysfunction, oxidative stress, and peripheral nerve injury. Furthermore, multivariate analysis demonstrated that the combination of HbA1c, ABI, and SpO_2 provides a more comprehensive assessment of diabetic neuropathy risk than each parameter alone, highlighting the importance of a multidimensional approach for the early detection of diabetic neuropathy (Wang & Hng, 2021).

The findings of this study suggest that diabetic neuropathy screening should be performed comprehensively by combining HbA1c measurement, SpO_2 assessment, ABI evaluation, and peripheral nerve function assessment using the Comprehensive Diabetic Neuropathy Screening Algorithm (CDNSA). This integrated approach enables earlier identification of high-risk patients, allowing timely interventions, including optimal glycemic control, increased physical activity, education to improve treatment adherence, diabetic foot care, and regular monitoring of peripheral circulation. Consequently, complications such as diabetic foot ulcers, infections, and lower-limb amputations may be prevented, thereby improving the quality of life of patients with diabetes mellitus (Pamungkas & Usman, 2021).

CONCLUSION

This study demonstrated significant associations between peripheral oxygen saturation (SpO_2), the Ankle Brachial Index (ABI), HbA1c levels, and the occurrence of diabetic neuropathy in patients with type 2 diabetes mellitus. Patients with low SpO_2, abnormal ABI, and elevated HbA1c levels had a higher risk of developing diabetic neuropathy. These findings highlight the important roles of both metabolic and vascular factors in the pathogenesis of diabetic neuropathy and support the implementation of comprehensive screening using the Comprehensive Diabetic Neuropathy Screening Algorithm (CDNSA) in primary healthcare settings.

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