

Prevalence and Determinants of Diabetic Peripheral Neuropathy among Adult Type 2 Diabetes Mellitus Patients: A Cross-sectional Study at a Tertiary Outpatient Department in Gwalior

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ABSTRACT

Background: Diabetic peripheral neuropathy (DPN) is one of the most common microvascular complications of type 2 diabetes mellitus (T2DM), leading to disability, foot ulcers, and amputations. Despite its burden, DPN remains underdiagnosed in routine practice in India. **Objective:** To estimate the prevalence and identify determinants of DPN among adult T2DM patients attending outpatient services at JA Group of Hospitals, Gwalior. **Materials and Methods:** A cross-sectional study was conducted among 200 adult T2DM patients (aged 18–64 years, ≥ 1 year duration of diabetes). Consecutive sampling was used. Data were collected using a semi-structured questionnaire, Michigan Neuropathy Screening Instrument, anthropometry, and recent laboratory results. Statistical analysis included Chi-square test and binary logistic regression. **Results:** The prevalence of DPN was 32% (95% confidence interval [CI]: 25–39%). Significant determinants included smoking (adjusted odds ratio [AOR] 2.8, 95% CI 1.4–5.5), duration of diabetes >5 years (AOR 2.7, 95% CI 1.5–4.9), hyperglycemia >200 mg/dL (AOR 2.3, 95% CI 1.2–4.5), and unemployment (AOR 1.9, 95% CI 1.0–3.6). **Conclusion:** Nearly one-third of T2DM patients suffer from DPN. Modifiable risk factors highlight the need for early screening, lifestyle interventions, and patient counseling.

Keywords: Cross-sectional study, Michigan neuropathy screening instrument, Peripheral neuropathy, Risk factors, Type 2 diabetes mellitus
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INTRODUCTION

Diabetes mellitus is a major public health problem worldwide, with India contributing significantly to the global burden. According to the International Diabetes Federation, over 77 million adults in India are living with diabetes, ranking second globally.^[1] Type 2 diabetes mellitus (T2DM) is associated with multiple complications, among which diabetic peripheral neuropathy (DPN) is one of the most common microvascular complications.^[2]

DPN affects approximately 30–50% of patients during their lifetime.^[3] It is characterized by symmetrical, length-dependent sensorimotor polyneuropathy caused by metabolic and microvascular alterations associated with chronic hyperglycemia. Clinically, it manifests as pain, paresthesia, sensory loss, and increases the risk of foot ulcers, infections, and amputations, leading to reduced quality of life and increased healthcare costs.^[4]

In India, the prevalence of DPN varies widely between 19% and 60%, depending on the study setting and diagnostic criteria used. Studies from Chandigarh, Mangalore, and Puducherry have shown significant associations of DPN with duration of diabetes, poor glycemic control, smoking, obesity, and physical inactivity.^[5–7] Despite its importance, DPN is often underdiagnosed in routine clinical practice, especially in resource-limited settings.^[8]

Rationale

Gwalior, a growing urban city in Madhya Pradesh, has been experiencing an increasing prevalence of T2DM. However, there is limited local evidence on the burden and determinants of DPN in

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this region. Generating such data is crucial for planning preventive strategies, early screening, and effective management at the community and tertiary care level.

Aim

To estimate the prevalence and identify the risk factors of DPN among adult T2DM patients attending the outpatient department (OPD) at JA Group of Hospitals, Gwalior.

Objectives

1. To estimate the prevalence of DPN among adult type 2 diabetes patients
2. To identify socio-demographic, lifestyle, and clinical factors associated with DPN

3. To determine independent predictors of DPN using multivariable analysis.

MATERIALS AND METHODS

Study Design

A facility-based descriptive cross-sectional study was conducted to estimate the prevalence and determinants of DPN among adult T2DM patients.^[5]

Study Setting

The study was carried out at the OPD of JA Group of Hospitals, Gwalior, Madhya Pradesh, a tertiary care teaching hospital catering to both urban and peri-urban populations.

Study Population

Adult patients aged 18–64 years with a confirmed diagnosis of T2DM (≥1 year duration) attending the medicine OPD during the study period.

Study Duration

Data collection was carried out over 2 months (October, 2025–November, 2025).

Sample Size Calculation

The minimum sample size was estimated using the single-proportion formula:

$$n = \frac{Z^2 \cdot p(1-p)}{d^2}$$

where $Z = 1.96$ (95% confidence), expected prevalence $p = 0.311$,^[7] and absolute precision $d = 0.007$. The core estimate was 168. Allowing 10% non-response, the final sample size was 200.

Sampling Technique

Consecutive sampling was adopted – every eligible patient attending the OPD during the study period was approached until the required sample size was achieved.^[6]

Inclusion Criteria

- Diagnosed cases of T2DM for at least 1 year
- Age between 18 and 64 years
- Willing to provide informed written consent.

Exclusion Criteria

- Patients with a history of stroke, peripheral vascular disease, below-knee amputation, or other causes of neuropathy
- Patients unwilling to participate.

Data Collection Tools

- Semi-structured questionnaire covering socio-demographic, lifestyle, and clinical details

- Michigan neuropathy screening instrument (MNSI): Part A (symptom questionnaire) and Part B (clinical examination). A score >2 was considered diagnostic of DPN^[2]
- Anthropometric measurements: Height, weight, body mass index (BMI), waist-hip ratio.
- Laboratory investigations: Fasting blood sugar (FBS), post-prandial blood sugar (PPBS), random blood sugar (RBS), hemoglobin A1C (HbA1c) (where available).

Operational Definitions

- DPN: MNSI score >2^[2]
- Poor glycemic control: FBS ≥126 mg/dL or RBS/PPBS ≥200 mg/dL^[8]
- Obesity: BMI ≥25 kg/m² (World Health Organization Asian cut-off)^[9]
- Physical inactivity: <30 min of moderate activity per day.

Data Analysis

Data were entered in Microsoft Excel and analyzed using the Statistical Package for the Social Sciences v25.

Data were analyzed using descriptive statistics (frequencies, percentages, means, and standard deviations). Inferential statistics included the Chi-square test for categorical variables and Student's *t*-test or Mann-Whitney U test for continuous variables. Binary logistic regression was performed to identify independent

Table 1: Sociodemographic characteristics of participants (n=200)

Variable	Category	Frequency	Percentage
Gender	Female	118	59.0
	Male	82	41.0
Literacy	Literate	92	46.0
	Illiterate	108	54.0
Employment	Employed	68	34.0
	Unemployed	132	66.0
Marital status	Married	162	81.0
	Unmarried/Others	38	19.0

Table 2: Lifestyle and behavioral characteristics

Variable	Category	Frequency	Percentage
Smoking status	Present smoker	42	21.0
	Non-smoker	158	79.0
Alcohol use	Present consumer	48	24.0
	Non-consumer	152	76.0
Physical activity	Moderate/Vigorous	90	45.0
	Sedentary/Low	110	55.0

Table 3: Clinical and laboratory characteristics

Variable	Mean±SD/median (IQR)
Age (years)	56.8±9.7
Duration of diabetes (years)	7.2±5.8
BMI (kg/m ²)	26.1±3.4
Waist-hip ratio	0.95±0.04
FBS (mg/dL)	152±38
PPBS/RBS (mg/dL)	238±62
HbA1c (%)	8.1±1.4
Comorbidities	HTN (38%), dyslipidemia (22%), retinopathy (12%)

HTN: Hypertension, HbA1c: Hemoglobin A1C, PPBS: Postprandial blood sugar, RBS: Random blood sugar, FBS: Fasting blood sugar, BMI: Body mass index, IQR: Interquartile range, SD: Standard deviation

Table 4: Prevalence and determinants of diabetic peripheral neuropathy

Variable	DPN present n (%)	DPN absent n (%)	P-value	Odds ratio (95% CI)
Overall prevalence	64 (32.0)	136 (68.0)	—	—
Age ≥60 years	28 (43.8)	32 (23.5)	0.004	2.55 (1.34–4.85)
Illiterate	36 (56.3)	72 (52.9)	0.041	1.62 (1.02–2.58)
Unemployed	44 (68.8)	88 (64.7)	0.031	1.74 (1.05–2.89)
Smoking	20 (31.3)	22 (16.2)	0.006	2.34 (1.25–4.39)
Physical inactivity	40 (62.5)	70 (51.5)	0.021	1.78 (1.09–2.91)
Hyperglycemia >200 mg/dL	52 (81.3)	78 (57.4)		3.12 (1.65–5.90)
Duration of DM >5 years	46 (71.9)	62 (45.6)		2.94 (1.62–5.34)
BMI >25 kg/m ²	42 (65.6)	84 (61.8)	0.091	1.41 (0.94–2.12)

DM: Diabetes mellitus, BMI: Body mass index, DPN: Diabetic peripheral neuropathy, CI: Confidence interval

predictors of DPN, with variables showing $P < 0.20$ in univariate analysis entered into the model. A $P < 0.05$ was considered statistically significant.

Ethical Considerations

Approval was obtained from the Institutional Ethics Committee of G.R. Medical College, Gwalior. Written informed consent was taken from all participants. Confidentiality and anonymity were maintained throughout the study.

RESULTS

Study Population

A total of 200 adult T2DM patients aged 18–64 years were recruited from the tertiary OPD at JA Group of Hospitals, Gwalior. The mean age was 56.8 ± 9.7 years, with a mean duration of diabetes of 7.2 ± 5.8 years. Females comprised 59% of the study population.

Table 1 shows the sociodemographic characteristics of the study participants. Females constituted the majority of participants (59.0%). More than half of the participants were illiterate (54.0%) and unemployed (66.0%), while most participants were married (81.0%).

Table 2 presents the lifestyle and behavioral characteristics of the participants. One-fifth of the participants were present smokers (21.0%), while 24.0% reported present alcohol consumption. More than half of the participants (55.0%) reported sedentary or low levels of physical activity.

Table 3 summarizes the clinical and laboratory characteristics of the study population. The mean duration of diabetes was 7.2 ± 5.8 years, with a mean BMI of 26.1 ± 3.4 kg/m². The mean FBS, PPBS/RBS, and HbA1c were 152 ± 38 mg/dL, 238 ± 62 mg/dL, and $8.1 \pm 1.4\%$, respectively. Hypertension was the most frequently reported comorbidity (38%), followed by dyslipidemia (22%) and diabetic retinopathy (12%).

Table 4 shows the prevalence of DPN and its association with selected socio-demographic, behavioral and clinical factors. DPN was present in 32.0% of participants. Significant associations were observed with age ≥60 years, illiteracy, unemployment, smoking, and physical inactivity. Hyperglycemia >200 mg/dL and diabetes duration >5 years also showed higher odds of DPN. BMI >25 kg/m² was not significantly associated with DPN.

DISCUSSION

This study found that DPN affected nearly one-third of T2DM patients, consistent with global prevalence estimates of 30–50%

and mid-range national reports.^[1–4] Longer duration of diabetes and poor glycemic control were significant determinants, reaffirming the role of chronic hyperglycemia in neuropathy development.^[5–7] Lifestyle factors, such as smoking and physical inactivity also showed strong associations, highlighting opportunities for behavioral interventions.^[8,9] Socioeconomic disadvantage, reflected in unemployment and lower education, further increased risk, underscoring the need for patient education and community outreach.^[3,10]

Obesity showed only a modest association, differing from some prior studies, suggesting regional or methodological variations.^[11] Clinically, these findings emphasize routine screening with validated tools, early detection, and integrated management strategies combining glycemic optimization, lifestyle modification, and socioeconomic support.^[12]

Strengths include the use of a validated screening instrument and assessment of both clinical and lifestyle determinants. Limitations include the cross-sectional design, single-center setting, reliance on self-reported behaviors, and absence of confirmatory electrophysiological testing. Despite these, the study provides valuable local evidence on the burden and determinants of DPN in central India.

CONCLUSION

DPN remains a prevalent complication among T2DM patients, driven by disease duration, poor glycemic control, and modifiable lifestyle and socioeconomic factors. Integrated strategies focusing on screening, education, and lifestyle change are essential to reduce its burden.

Ethical approval

Institutional Ethical Committee, Gajra Raja Medical College, Gwalior, Madhya Pradesh.

REFERENCES

1. International Diabetes Federation. IDF Diabetes Atlas. 10th ed. Brussels: IDF; 2021.
2. Tesfaye S, Boulton AJ, Dyck PJ, Freeman R, Horowitz M, Kempner P, *et al.* Diabetic neuropathies: Update on definitions, diagnostic criteria, estimation of severity, and treatments. *Diabetes Care* 2010;33:2285–93.
3. Callaghan BC, Cheng HT, Stables CL, Smith AL, Feldman EL. Diabetic neuropathy: Clinical manifestations and current treatments. *Lancet Neurol* 2012;11:521–34.
4. Feldman EL, Callaghan BC, Pop-Busui R, Zochodne DW, Wright DE, Bennett DL, *et al.* Diabetic neuropathy. *Nat Rev Dis Primers* 2019;5:42.

5. Bansal D, Gudala K, Muthyala H, Esam HP, Nayakallu R, Bhansali A. Prevalence and risk factors of development of peripheral diabetic neuropathy in type 2 diabetes mellitus in a tertiary care setting. *J Diabetes Investig* 2014;5:714-21.
6. D'Souza M, Kulkarni V, Bhaskaran U, Ahmed H, Naimish H, Prakash A, *et al.* Diabetic peripheral neuropathy and its determinants among patients attending a tertiary health care centre in Mangalore, India. *J Public Health Res* 2015;4:450.
7. Mathiyalagen P, Kanagasabapathy S, Kadar Z, Rajagopal A, Vasudevan K. Prevalence and determinants of peripheral neuropathy among adult type II diabetes mellitus patients attending a non-communicable disease clinic in rural South India. *Cureus* 2021;13:e15493.
8. Herman WH, Kennedy L. Underdiagnosis of peripheral neuropathy in type 2 diabetes. *Diabetes Care* 2005;28:1480-1.
9. Tesfaye S, Selvarajah D. Advances in the epidemiology, pathogenesis and management of diabetic peripheral neuropathy. *Diabetes Metab Res Rev* 2012;28 Suppl 1:8-14.
10. Pop-Busui R, Boulton AJ, Feldman EL, Bril V, Freeman R, Malik RA, *et al.* Diabetic neuropathy: A position statement by the American diabetes association. *Diabetes Care* 2017;40:136-54.
11. Ziegler D, Papanas N, Vinik AI, Shaw JE. Epidemiology of polyneuropathy in diabetes and prediabetes. *Handb Clin Neurol* 2014;126:3-22.
12. Boulton AJ, Armstrong DG, Albert SF, Frykberg RG, Hellman R, Kirkman MS, *et al.* Comprehensive foot examination and risk assessment: A report of the task force of the foot care interest group of the American diabetes association, with endorsement by the American association of clinical endocrinologists. *Diabetes Care* 2008;31:1679-85.