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Diabetic Peripheral Neuropathies in Type 2 Diabetes at Brazzaville University Hospital: Prevalence and Associated Factors

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Abstract

Introduction: Diabetic peripheral neuropathy (DPN) is a frequent and disabling complication of type 2 diabetes mellitus (T2DM), often underdiagnosed. This study aimed to determine the prevalence of DPN and identified its associated factors among T2DM patients in Brazzaville. **Methods:** A descriptive and analytical cross-sectional study was conducted from February to July 2024 among T2DM patients at the Brazzaville University Hospital. Patients aged 18 and older, who underwent neurological and electroneuromyographic (ENMG) assessment, were included. Multivariate logistic regression was used to identify factors associated with DPN. **Results:** Of 102 patients included, 81 (79.4%) were diagnosed with DPN. Carpal tunnel syndrome (87%) and distal sensorimotor polyneuropathy (37%) were the most frequent presentations. ENMG revealed 18.5% of subclinical cases. The mean age of patients with DPN was 59.75 ± 9.87 years. Advanced age (OR = 1.069; p = 0.027) and longer duration of diabetes (OR = 1.034; p = 0.034) were significantly associated with DPN. **Conclusion:** DPN is highly prevalent among T2DM patients in Brazzaville. Routine ENMG at diagnosis is recommended to facilitate early detection and limits complications.

Keywords

Type 2 Diabetes, Diabetic Peripheral Neuropathy, Prevalence, Associated Factors, Brazzaville, Sub-Saharan Africa

1. Introduction

Diabetes mellitus (DM) is a major public health issue globally. According to the International Diabetes Federation (IDF), an estimated 588.7 million people had diabetes worldwide in 2023, including 24.6 million in Africa. These figures are projected to rise to 852.5 million globally and 59.5 million in Africa by 2050 [1]. Consequently, diabetes represents an escalating burden on global health systems [2].

Type 2 diabetes mellitus (T2DM) is the most common form, accounting for approximately 96% of all diabetes cases [3]. It is a chronic condition with various complications, particularly microvascular and macrovascular. Among microvascular complications, diabetic neuropathies (DN) are frequent. DN may involve the somatic peripheral nervous system, resulting in peripheral neuropathy (PN), or the autonomic nervous system, leading to autonomic neuropathy (AN). Approximately 50% of diabetic patients develop neuropathy during their lifetime, making T2DM the leading global cause of PN [4]. Recent studies in sub-Saharan Africa have reported a high prevalence of diabetic peripheral neuropathy (DPN) ranging from 34.8% to 65.8%. Multiple associated factors have been identified, including diabetic imbalance, diabetic retinopathy, and dyslipidemia [5] [6].

DPN is defined by the presence of symptoms and/or electrophysiological evidence of peripheral nerve dysfunction associated with diabetes, after excluding other causes [7]. Its clinical presentation is variable, ranging from painful, paresthesia, or motor symptoms to asymptomatic or subclinical forms, often discovered incidentally. This heterogeneity complicates early diagnosis, although subclinical forms carry the same risks of severe complications [8].

DPN significatively contributes to the development of foot ulcers and Charcot arthropathy, making it a leading cause of lower-limb amputations worldwide [9]. In Congo, the estimated average cost of managing diabetes complications was 519,461 FCFA (approximatively 865,77 USD) in 2023 [10].

Early diagnosis of DPN is therefore a public health priority. Diagnosis is primarily clinical, but ENMG provides valuable support, especially for detecting subclinical cases. However, few studies have integrated systematic electrophysiological evaluation in the context of diabetes.

This study aimed to estimate the prevalence of DPN and identify associated factors among T2DM patients at Brazzaville University Hospital.

2. Patients and Methods

2.1. Study Design and Setting

This cross-sectional analytical study was conducted over six months, from February 1 to July 31, 2024. It was carried out in the outpatient metabolic and endocrine disease unit and the clinical neurophysiology laboratory of the Neurology Department at Brazzaville University Hospital.

2.2. Participants

The study population included all T2DM patients followed at the outpatient metabolic and endocrine disease unit. Participants were recruited exhaustively. Inclusion criteria were age ≥ 18 years, documented T2DM, available glycosylated hemoglobin (HbA1c) value, ENMG assessment, and signed informed consent. Patients with a known cause of peripheral neuropathy (e.g., chronic alcohol use, HIV infection, malignancy, systemic diseases, chemotherapy, neurotoxic drugs), foot deformities, ulcerations, or amputation preventing ENMG, and those with cognitive or psychiatric disorders impairing consent and comprehension were excluded.

2.3. Data Collection

Data were collected using a standardized questionnaire. Information included sociodemographic data, medical and diabetes history, and treatment adherence assessed by the Morisky Medication Adherence Scale. Neurological evaluation included DN4 screening for neuropathic pain, measurement of the ankle-brachial index (ABI) via Doppler after 30 minutes of supine rest, and ENMG.

2.4. ENMG Protocol

Examinations were scheduled according to patient availability and conducted under optimal technical conditions (controlled skin temperature at 37°C). The following nerves were explored: median and ulnar nerves (motor and sensory components) in the upper limbs; common fibular, tibial (motor), and sural (sensory) nerves in the lower limbs. Standardized techniques were used for nerve stimulation and recording. Needle EMG was not performed due to its invasive nature. Motor parameters included distal/proximal latencies and amplitudes, conduction velocity, and F-wave latency. Sensory parameters included sensory latency, amplitude, and conduction velocity. Interpretation followed University Hospital of Brazzaville standards and ENFS/PNS guidelines [11] [12].

2.5. Assessment Criteria

DPN was categorized as electro-clinical (presence of clinical signs and ENMG abnormalities), clinical (presence of clinical signs only), subclinical (presence of ENMG abnormalities only), or none (absent of both clinical and ENMG findings).

According to the recommendations of the American Diabetes Association (ADA), diabetes control was defined as reaching a glycosylated hemoglobin (HbA1c) level of ≤7%. The ABI was interpreted as follows [13]: >1.30, non-compressible arteries or medial arterial calcification (MAC); 0.90 - 1.30, normal; <0.9, peripheral arterial occlusive disease (PAOD).

2.6. Statistical Analysis

The data were entered into Microsoft Excel and analyzed using Jamovi v2.6.17. Categorical variables were expressed as frequencies and percentages, and continuous variables were expressed as the mean ± standard deviation or the median [interquartile range (IQR)], depending on the results of the Shapiro-Wilk test.

Categorical comparisons used the Chi-square or Fisher's exact test. Continuous data comparisons used a Student's t-test or a Mann-Whitney test. Multivariate logistic regression was performed to identify factors associated with DPN. Variables with $p < 0.20$ in the univariate analysis were included in the multivariate model. Model fit was evaluated using the Hosmer and Lemeshow test. The significance threshold was set at $p < 0.05$.

2.7. Ethical Considerations

All participants provided written informed consent prior to being included in the study. The study protocol was reviewed and approved by the Ethics and Research Committee of the Faculty of Health Sciences at Marien Ngouabi University. All procedures were conducted in accordance with the principles outlined in the Declaration of Helsinki. Patients diagnosed with DPN were referred to the neurology outpatient unit for appropriate management, including optimization of glycemic control, treatment of neuropathic pain, lifestyle advice, and prevention of complications, such as foot ulcers. These patients were subsequently monitored as part of their routine diabetes care.

The authors declare that they have no conflicts of interest related to this study.

3. Results

3.1. Prevalence of DPN

Of the 220 patients with type 2 diabetes mellitus (T2DM) selected, 102 completed clinical and electrophysiological investigations, yielding a participation rate of 46.3%. The remaining 118 patients did not undergo ENMG because they missed their appointment.

DPN was diagnosed in 81 patients, representing a prevalence of 79.4%.

3.2. Sociodemographic and Anthropometric Characteristics

The mean age of patients with DPN was 59.75 ± 9.87 years, ranging from 38 to 82 years old. Of these patients, 56 were women (69.1%) and 25 were men (30.9%), resulting in a male-to-female ratio of 0.44.

Table 1 summarizes occupational status, socioeconomic and education levels.

3.3. Body Mass Index

The mean BMI was 28.2 ± 5.7 kg/m^2 (range: 16.8 - 44.1). Patients were evenly distributed among normal weight, overweight, and obese categories (33.3% in each).

3.4. Diabetes History

The median duration of diabetes was 20 months (approximately 1.7 years), and the mean was 56.4 ± 71.5 months (approximately 4.7 ± 6 years). The range was 1 - 384 months.

The ABI was normal in 59.3% of cases and abnormal in 40.7%, with PAOD predominating (63.6%) over MAC (36.4%).

Table 1. Occupational status, socioeconomic and education levels.

	n	%
Occupational status		
Retired	26	32.1
Administrative officer	12	14.8
Sales	10	12.3
Teacher	3	3.7
Farmer	2	2.5
Unemployed	20	24.7
Others*	8	9.9
Socioeconomic level		
High	2	2.5
Medium	49	60.5
Low	30	37
Education level		
Primary	5	6.2
Secondary	51	62.9
Higher	24	29.6
None	1	1.2

*Others: policeman (n = 2), brewer (n = 1), orderly (n = 1), driver (n = 1), electrician (n = 1), nurse (n = 1) and pastor (n = 1).

Associated complications included nephropathy (12.3%), stroke (8.6%), coronary artery disease (3.7%), and retinopathy (2.5%).

Regarding treatment, 61.7% were on oral antidiabetics (OADs), 19.8% were on insulin, and 18.5% were on both. Treatment adherence was high in 49.4% of patients, moderate in 42% and low in 8.6%.

The mean HbA1c was 8.7% ± 2.1% (range: 5.1-15%). Glycemic control (HbA1c ≤ 7%) was achieved by 19.6% (n = 20) of patients.

3.5. Clinical Features of Peripheral Neuropathy

DPN was clinically suspected in 66 patients (81.5%).

3.5.1. Subjective Complaints

Previous paresthesia was reported by 25.9% of patients. Eighty-one-point five percent of patients had current neuropathic symptoms, including paresthesia (100%), cramps (28.8%), and neuropathic pain (21.2%). Symptoms had persisted for more than six months in 92.4% of patients.

3.5.2. Objective Clinical Signs

Objective clinical signs were present in 33 patients (40.7%). These signs included the absence of osteotendinous reflexes (63.6%), thermal hypoesthesia (63.6%), amyotrophy of the thenar eminence or leg (9.1%), and vibratory hypoesthesia (3%).

3.6. Electrophysiological Characteristics

ENMG confirmed DPN in 54 patients (66.7%). Of the 66 cases suspected clinically cases, ENMG confirmed 81.8%. Twelve patients (18.2%) had no ENMG abnormalities, which suggests small fiber involvement. Conversely, 18,5% of DPN cases were subclinical, presenting only with ENMG abnormalities.

There was no significant association between subjective symptoms and ENMG abnormalities (p = 0.109).

Table 2 presents DPN types identified by ENMG.

Table 2. Types of diabetic peripheral neuropathy identified by ENMG.

	n	%
Mononeuropathy	47	87
Carpal tunnel syndrome	45	95.7
Symmetrical ulnar sensory neuropathy	2	4.3
Polyneuropathy	20	37
Topography		
Four members	17	85
Lower limbs	2	10
Upper limbs	1	5
Type of nerve fibers affected		
Sensorimotor	16	80
Sensory only	4	20
Mechanism of injury		
Axonal damage	17	85
Demyelination	3	15
Radiculopathies	10	18.5
L5 radiculopathy	7	70
S1 radiculopathy	3	30
Multiple mononeuropathy	1	1.8

3.7. Correlation between DPN Types and Clinical Variables

DPN types were significantly associated with diabetes duration (p = 0.001), but not with age, BMI, or HbA1c levels. See Table 3 for detailed results.

3.8. Factors Associated with the Occurrence of DPN

Univariate analysis revealed associations with age (p = 0.009), diabetes duration (p = 0.034), right ABI (p = 0.040), and the Morisky adherence scale (p = 0.002) (see Table 4).

Table 3. Correlation between DPN types and clinical variables.

	Mean ± SD	Extremes	Median	*p-value*
Age (years)				0.333
Subclinical	60.5 ± 11.2	40 - 81	62	
Clinical	55.8 ± 10.4	38 - 71	54	
Electro-clinical	60.4 ± 9.4	41 - 78	60	
Progression time (months)				0.001
Subclinical	24.1 ± 52.7	1 - 240	7	
Clinical	33.8 ± 44.6	2 - 120	12	
Electro-clinical	70.5 ± 77.2	1 - 384	42	
BMI (kg/m²)				
Subclinical	26.5 ± 4.8	20.6 - 38.7	26.9	0.633
Clinical	29.2 ± 5.6	19.5 - 44.1	27.5	
Electro-clinical	27.8 ± 6.4	18.2 - 41.8	26.2	
HbA1c level (%)				
Subclinical	8.5 ± 1.8	5.1 - 11.4	8.7	0.095
Clinical	7.7 ± 1.4	6 - 10	7.2	
Electro-clinical	9.1 ± 2.3	5.3 - 15	8.9	

DPN: diabetic peripheral neuropathy, BMI: body mass index, HbA1c: glycated hemoglobin.

Table 4. Univariate analysis of factors associated with presence of DPN.

	DPN absent N = 21	DPN present N = 81	*p-value*
Age (years)*	52.1 ± 11.4	59.8 ± 9.9	0.009
Gender, n (%)			
Male	7 (33.3)	25 (30.8)	1.000
Female	14 (66.6)	56 (69.1)	
Socioeconomic level, n (%)			
Low	8 (38)	30 (37)	
Medium	10 (47.6)	49 (60.4)	0.073
High	3 (14.2)	2 (2.4)	
Education level, n (%)			
Primary	-	5 (6.2)	0.618

Continued

Secondary	14 (66.7)	51 (63)	
Higher	6 (28.6)	24 (29.6)	
None	1 (4.7)	1 (1.2)	
Diabetes duration (months)	11.8 ± 20.4	56.4 ± 71.5	0.034
HbA1c rate (%)	8.5 ± 0.6	8.7 ± 5.7	0.680
Morisky score	0.3 ± 0.5	0.9 ± 1	0.002
Body mass index (kg/m^2)	28.1 ± 5	28.2 ± 5.7	0.950
Ankle-brachial index (mmHg)			
Left	1.1 ± 0.2	1.1 ± 0.2	0.230
Right	1.1 ± 0.1	1.0 ± 0.2	0.040
Arteriopathy, n (%)			
Absent	16 (76.2)	48 (59.3)	
PAOD	3 (14.3)	21 (25.9)	0.357
MAC	2 (9.5)	12 (14.8)	

DPN: diabetic peripheral neuropathy, PAOD: peripheral arterial occlusive disease, MAC: medial arterial calcification. *Mean ± standard deviation.

Five covariates with a $p < 0.20$ were included in the multivariate logistic regression: age, diabetes duration, right ABI, Morisky score, and sociodemographic level. With 81 events (patients with DPN), the events-per-variable ratio was 16.2, meeting accepted methodological standards. The multivariate logistic regression analysis identified advanced age (OR = 1.069 [95% CI: 1.008 - 1.134]; p = 0.027) and longer diabetes duration (OR = 1.034 [95% CI: 1.002 - 1.066]; p = 0.034) as independent predictors. The other variables were excluded during stepwise selection due to a lack of statistical significance, suggesting that their effects were confounded or not independently associated with the outcome.

4. Discussion

4.1. Prevalence of DPN

The 79.4% prevalence rate observed in our study is higher than the rates reported in INTERPRET-DD study (26.7%) and an African meta-analysis (46%) [14] [15]. The INTERPRET-DD study included 2733 patients with T2DM from 14 countries worldwide. The African meta-analysis involved 33 studies with 269,691 participants. The estimated prevalence in Central Africa was the lowest, at 35.9%. This difference may be explained by the use of ENMG, which identified 18.5% of subclinical cases.

Similar rates were reported in the neurological functional explorations unit at Limoges University Hospital (87.3%) and among elderly patients undergoing ENMG in Tunis (89.4%) [16] [17]. Other studies using clinical criteria report lower prevalence rates ranging from 14.3% to 44% [18] [19]. In Mali, a prevalence of 69.8% was reported when autonomic neuropathies were included [20]. At Brazzaville University Hospital, 93.13% of patients with diabetic foot syndrome had DPN [10].

This variability can be attributed to diagnostic methods, population characteristics, and care quality. However, one study reported no significant geographical variation [21].

4.2. Clinical and Electrical Characteristics of Peripheral Neuropathy

Consistent with its known association in diabetics, carpal tunnel syndrome (87%) was the most frequent form [22]-[25]. The pathophysiological mechanisms include endoneural glucose accumulation, ischemia, and compression due to musculoskeletal alterations [23] [24] [26] [27].

The second most common form was polyneuropathy (37%), which was mainly sensorimotor, axonal, and diffuse, aligning with existing literature [28]-[32]. Oxidative stress appears to be the common pathway for nerve damage induced by hyperglycemia [33]-[35].

The prevalence of neuropathic pain (21.2%) was lower than in other studies (36.8% to 56.7%) [36] [37]. Radiculopathies were rare and difficult to distinguish from common sciatica [38]-[40].

The 18.5% rate of subclinical DPN supports the use of systematic ENMG at diagnosis. Up to 50% of DPN may be asymptomatic, which exposes patients to insensitive foot lesions [41]. The shorter median onset time of seven months underscores the early manifestation of these forms compared to clinical forms, which have median onset times of 12 months for small fibers and 42 months for large fibers. Furthermore, clinical symptoms did not influence ENMG results.

4.3. Factors Associated with the Occurrence of Peripheral Neuropathy

Several factors have been linked to the development of DPN in patients with T2DM [42] [43]. Consistent with prior studies, age and diabetes duration were significantly associated with DPN [14] [18] [21] [44]. Other known risk factors include poor glycemic control, smoking, sedentary behavior, obesity, cardiovascular disease, microalbuminuria, severe ketoacidosis, and retinopathy [14] [18] [19] [21] [42]-[44]. However, in our study, neither ABI abnormalities nor HbA1c level were significantly associated with DPN, despite 40.7% of participants having ABI abnormalities and the mean HbA1c level being 8.7%.

The prevalence of DP increases with diabetes duration, rising from 7% in the first year to 50% after 20 years [45]. This is consistent with reports linking DPN to diabetes durations of over 15 years [31]. The main mechanisms involved in nerve degeneration are chronic oxidative stress and metabolic pathway overload induced by hyperglycemia [46]. Thus, while treatment adherence was not associated with DPN occurrence in the multivariate analysis, it was significantly lower among patients with DPN in the univariate analysis. This reflects the increased risk of poor glycemic control associated with DPN development. Furthermore, these patients had slightly higher mean HbA1c levels, and nearly half of them were taking oral antidiabetics medication.

4.4. Strengths and Limitations

This study has several strengths. First, the systematic use of ENMG enabled the detection of both clinical and subclinical forms of DPN. Second, the rigorous exclusion of alternative causes of neuropathy ensured diagnostic specificity. Conducted in a real-world hospital setting, the study also identified key associated factors, such as age and diabetes duration. However, the cross-sectional design limits causal interpretation, and the relatively small sample size and single-center setting may affect generalizability. Only 102 out of 220 eligible patients completed the full protocol, potentially introducing selection bias. Additionally, this study did not include specific tests for assessing small fibers, such as quantitative sensory testing or skin biopsies, due to the limited availability of these techniques in our setting. Consequently, some cases of small fiber neuropathy may have gone undetected, particularly in patients with normal ENMG results. This limitation may have led to an underestimation of DPN prevalence in the early stages or in its sensory form. Additionally, the lack of longitudinal follow-up for treatment outcomes limits our ability to assess treatment effectiveness.

5. Conclusion

Diabetic peripheral neuropathy is common among patients with type 2 diabetes mellitus (T2DM) at Brazzaville University Hospital, with carpal tunnel syndrome and distal sensorimotor polyneuropathies being the most prevalent forms. The detection of subclinical DPN in nearly 20% of patients underscores the importance of conducting ENMG screenings as soon as diabetes is diagnosed. Age and duration of diabetes are key predictive factors. Early detection and neurological monitoring are crucial to preventing disabling complications.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] IDF (2024) Facts and Figures. International Diabetes Federation (IDF). https://idf.org/about-diabetes/diabetes-facts-figures/

[2] Schaper, N.C., Apelqvist, J. and Bakker, K. (2003) The International Consensus and Practical Guidelines on the Management and Prevention of the Diabetic Foot. *Current Diabetes Reports*, **3**, 475-479. https://doi.org/10.1007/s11892-003-0010-4

[3] Lu, X., Xie, Q., Pan, X., Zhang, R., Zhang, X., Peng, G., *et al.* (2024) Type 2 Diabetes Mellitus in Adults: Pathogenesis, Prevention and Therapy. *Signal Transduction and Targeted Therapy*, **9**, Article No. 262. https://doi.org/10.1038/s41392-024-01951-9

[4] Feldman, E.L., Callaghan, B.C., Pop-Busui, R., Zochodne, D.W., Wright, D.E., Bennett, D.L., *et al.* (2019) Diabetic Neuropathy. *Nature Reviews Disease Primers*, **5**, Article No. 41. https://doi.org/10.1038/s41572-019-0092-1

[5] Hode, A.K., Dedjan, H. and Sondjo, F.M. (2023) Peripheral Neuropathy and Associated Factors in Diabetics at the CNHU-HKM of Cotonou in 2021. *Journal of Diabetes Mellitus*, **13**, 12-22. https://doi.org/10.4236/jdm.2023.131002

[6] Munyambalu, D.K., Hildago, I., Bafwa, Y.T., Lagoro, C.A., Sikakulya, F.K., Vahwere, B.M., *et al.* (2023) Prevalence and Grade of Diabetic Peripheral Neuropathy among Known Diabetic Patients in Rural Uganda. *Frontiers in Clinical Diabetes and Healthcare*, **3**, Article ID: 1001872. https://doi.org/10.3389/fcdhc.2022.1001872

[7] Tesfaye, S., Boulton, A.J.M., Dyck, P.J., Freeman, R., Horowitz, M., Kempler, P., *et al.* (2010) Diabetic Neuropathies: Update on Definitions, Diagnostic Criteria, Estimation of Severity, and Treatments. *Diabetes Care*, **33**, 2285-2293. https://doi.org/10.2337/dc10-1303

[8] Boulton, A.J.M., Vinik, A.I., Arezzo, J.C., Bril, V., Feldman, E.L., Freeman, R., *et al.* (2005) Diabetic Neuropathies: A Statement by the American Diabetes Association. *Diabetes Care*, **28**, 956-962. https://doi.org/10.2337/diacare.28.4.956

[9] Bilal, A., Amarasena, D.K. and Pillai, A. (2023) Socioeconomic Deprivation as a Predictor of Lower Limb Amputation in Diabetic Foot Disease. *Cureus*, **15**, e44426. https://doi.org/10.7759/cureus.44426

[10] Elilie Mawa Ongoth, F., Andzouana Mbamognoua, N.G., Okoumou-Moko, A., Mayanda Ohouana, R.L., Bilongo Bouyou, A.S.W., Dinghat, O.M.Y., *et al.* (2023) Profil épidémiologique et diagnostique du pied diabétique au centre hospitalier universitaire de Brazzaville. *Health Sciences and Diseases*, **1**, 52-56. https://hsd-fmsb.org/index.php/hra/article/view/4961/3849

[11] Van den Bergh, P.Y.K., Hadden, R.D.M., Bouche, P., Cornblath, D.R., Hahn, A., Illa, I., *et al.* (2010) European Federation of Neurological Societies/Peripheral Nerve Society Guideline on Management of Chronic Inflammatory Demyelinating Polyradiculoneuropathy: Report of a Joint Task Force of the European Federation of Neurological Societies and the Peripheral Nerve Society—First Revision. *European Journal of Neurology*, **17**, 356-363. https://doi.org/10.1111/j.1468-1331.2009.02930.x

[12] Mpandzou, G., Bandzouzi, P.S., Diatewa, J., Kane, M., Moutoula-Latou, D., Kaba, Y., *et al.* (2022) Valeurs de référence des paramètres électroneuromyographiques du laboratoire de neurophysiologique clinique au centre hospitalier universitaire de Brazzaville. *Health Sciences and Diseases*, **23**, 23-27. https://www.hsd-fmsb.org/index.php/hsd/article/view/3421/2949

[13] HAS (2007) Prise en charge de l'artériopathie chronique oblitérante athéroscléreuse des membres inférieurs (indications médicamenteuses, de revascularisation et de rééducation): Service des recommandations professionnelles-avril 2006. *Annales de Dermatologie et de Vénéréologie*, **134**, 199-206. https://doi.org/https://doi.org/10.1016/S0151-9638(07)91621-X

[14] Lu, Y., Xing, P., Cai, X., Luo, D., Li, R., Lloyd, C., *et al.* (2020) Prevalence and Risk Factors for Diabetic Peripheral Neuropathy in Type 2 Diabetic Patients from 14 Countries: Estimates of the INTERPRET-DD Study. *Frontiers in Public Health*, **8**, Article ID: 534372. https://doi.org/10.3389/fpubh.2020.534372

[15] Shiferaw, W.S., Akalu, T.Y., Work, Y. and Aynalem, Y.A. (2020) Prevalence of Diabetic Peripheral Neuropathy in Africa: A Systematic Review and Meta-Analysis. *BMC Endocrine Disorders*, **20**, Article No. 49. https://doi.org/10.1186/s12902-020-0534-5

[16] Adoukonou, A., Magy, L., Gnonlonfoun, D., Gallouedec, G., Khalil, M. and Vallat, G.

(2010) Profil electroneuromyographique des neuropathies dans une population de patients diabetiques admis dans un laboratoire de neurophysiologie. *African Journal of Neurological Sciences*, **27**, 77-85. https://doi.org/10.4314/ajns.v27i2.55102

[17] Salha, S., Ghodhbane, Z. and Sghaier, S. (2018) Neuropathie Diabétique du Sujet Âgé: Étude Électro-Clinique. *Middle East Journal of Age and Ageing*, **15**, 67-67. https://doi.org/10.5742/mejaa.2018.93419

[18] Mekuria Negussie, Y. and Tilahun Bekele, N. (2024) Diabetic Peripheral Neuropathy among Adult Type 2 Diabetes Patients in Adama, Ethiopia: Health Facility-Based Study. *Scientific Reports*, **14**, Article No. 3844. https://doi.org/10.1038/s41598-024-53951-y

[19] Soni, K., Srivastava, D.K., Kumar, S., Bajpai, P.K., Shukla, S.K. and Prakash, S. (2024) Prevalence of Diabetic Peripheral Neuropathy among Type 2 Diabetes Mellitus Patients and Its Associated Risk Factors. *Indian Journal of Community Health*, **36**, 208-214. https://doi.org/10.47203/ijch.2024.v36i02.009

[20] Maiga, Y., Diallo, S., Konipo, F.d.N., Sangho, O., Sangaré, M., Diallo, S.H., *et al.* (2020) Diabetic Polyneuropathy with/out Neuropathic Pain in Mali: A Cross-Sectional Study in Two Reference Diabetes Treatment Centers in Bamako (Mali), Western Africa. *PLOS ONE*, **15**, e0241387. https://doi.org/10.1371/journal.pone.0241387

[21] Tesfaye, S., Stevens, L.K., Stephenson, J.M., Fuller, J.H., Plater, M., Ionescu-Tirgoviste, C., *et al.* (1996) Prevalence of Diabetic Peripheral Neuropathy and Its Relation to Glycaemic Control and Potential Risk Factors: The EURODIAB IDDM Complications Study. *Diabetologia*, **39**, 1377-1384. https://doi.org/10.1007/s001250050586

[22] Rekik, S., Kammoun, I., Triki, L., Affes, Z., Jemea, S.B., Zouari, H., *et al.* (2016) Particularités du syndrome du canal carpien chez les diabétiques: Étude castémoin. *Revue Neurologique*, **172**, A110. https://doi.org/10.1016/j.neurol.2016.01.263

[23] Zamfirov, K. (2017) Manifestations musculosquelettiques du diabète sucré: Une complication fréquente. *Revue Médicale Suisse*, **13**, 917-921. https://doi.org/10.53738/revmed.2017.13.560.0917

[24] Lahrichi, S., Nassar, K. and Janani, S. (2021) Le syndrome du canal carpien et le diabète. *Revue du Rhumatisme*, **88**, A169. https://doi.org/10.1016/j.rhum.2021.10.269

[25] Wei, Y., Xu, S., Wu, Z., Zhang, M., Bao, M. and He, B. (2024) Exploring the Causal Relationships between Type 2 Diabetes and Neurological Disorders Using a Mendelian Randomization Strategy. *Medicine*, **103**, e40412. https://doi.org/10.1097/md.0000000000040412

[26] Lebiedz-Odrobina, D. and Kay, J. (2010) Rheumatic Manifestations of Diabetes Mellitus. *Rheumatic Disease Clinics of North America*, **36**, 681-699. https://doi.org/10.1016/j.rdc.2010.09.008

[27] Zimmerman, M., Gottsäter, A. and Dahlin, L.B. (2022) Carpal Tunnel Syndrome and Diabetes—A Comprehensive Review. *Journal of Clinical Medicine*, **11**, Article No. 1674. https://doi.org/10.3390/jcm11061674

[28] Albers, J.W. and Pop-Busui, R. (2014) Diabetic Neuropathy: Mechanisms, Emerging Treatments, and Subtypes. *Current Neurology and Neuroscience Reports*, **14**, Article No. 473. https://doi.org/10.1007/s11910-014-0473-5

[29] Diédhiou, D., Touré, M., Cissé, M., Seck, L.B., Diop, S.N., Guèye, L., *et al.* (2015) P246 Neuropathie diabétique: Caractéristiques cliniques et électromyographiques au Sénégal. *Diabetes & Metabolism*, **41**, A95. https://doi.org/10.1016/s1262-3636(15)30359-1

[30] Dyck, P.J., Albers, J.W., Andersen, H., Arezzo, J.C., Biessels, G., Bril, V., *et al.* (2011)

Diabetic Polyneuropathies: Update on Research Definition, Diagnostic Criteria and Estimation of Severity. *Diabetes/Metabolism Research and Reviews*, **27**, 620-628. https://doi.org/10.1002/dmrr.1226

[31] Barbosa, A.P., Medina, J.L., Ramos, E.P. and Barros, H.P. (2001) Prevalence and Risk Factors of Clinical Diabetic Polyneuropathy in a Portuguese Primary Health Care Population. *Diabetes & Metabolism*, **27**, 496-502.

[32] Jarso, G., Ahmed, A. and Feleke, Y. (2011) The Prevalence, Clinical Features and Management of Periphral Neuropathy among Diabetic Patients in Tikur Anbessa and St. Paul's Specialized University Hospitals, Addis Ababa, Ethiopia. *Ethiopian Medical Journal*, **49**, 299-311.

[33] Allen, M.D., Doherty, T.J., Rice, C.L. and Kimpinski, K. (2016) Physiology in Medicine: Neuromuscular Consequences of Diabetic Neuropathy. *Journal of Applied Physiology*, **121**, 1-6. https://doi.org/10.1152/japplphysiol.00733.2015

[34] Nukada, H. (2014) Ischemia and Diabetic Neuropathy. In: *Handbook of Clinical Neurology*, Elsevier, 469-487. https://doi.org/10.1016/b978-0-444-53480-4.00023-0

[35] Perez-Matos, M.C., Morales-Alvarez, M.C. and Mendivil, C.O. (2017) Lipids: A Suitable Therapeutic Target in Diabetic Neuropathy? *Journal of Diabetes Research*, **2017**, Article ID: 6943851. https://doi.org/10.1155/2017/6943851

[36] Davies, M., Brophy, S., Williams, R. and Taylor, A. (2006) The Prevalence, Severity, and Impact of Painful Diabetic Peripheral Neuropathy in Type 2 Diabetes. *Diabetes Care*, **29**, 1518-1522. https://doi.org/10.2337/dc05-2228

[37] Oueslati, I., Ounaissa, K., Smida, A., Chelbi, S., Dag, N.B., Sallami, S., *et al.* (2018) La neuropathie diabétique périphérique: Prévalence et facteurs prédictifs. *Annales d'Endocrinologie*, **79**, Article No. 491. https://doi.org/10.1016/j.ando.2018.06.980

[38] Dyck, P.J.B. and Windebank, A.J. (2002) Diabetic and Nondiabetic Lumbosacral Radiculoplexus Neuropathies: New Insights into Pathophysiology and Treatment. *Muscle & Nerve*, **25**, 477-491. https://doi.org/10.1002/mus.10080

[39] Lamini, N., Soundhat, N.E., Nkouala-Kidede, D.C., Moigny-Gajou, Y., Ombou-mahou Bakale, F.E., Salemo, A.P., *et al.* (2023) Lombalgie commune chez le personnel soignant au CHU de Brazzaville: Aspects épidémiologiques, cliniques et étiologiques. *Rhumatologie Africaine Francophone*, **6**, 17-24. https://doi.org/10.62455/raf.v6i1.50

[40] Lamini, N., Soundhat, N.E., Angalla, A.R.L., Moigny-Gajou, Y., Nkouala-Kidede, D.C., Mbouale Ossemba, J.M., *et al.* (2023) Profil clinique et fonctionnel des patients suivis pour lombalgie commune au CHU de Brazzaville. *Rhumatologie Africaine Francophone*, **6**, 25-31. https://doi.org/10.62455/raf.v6i1.48

[41] Pop-Busui, R., Boulton, A.J.M., Feldman, E.L., Bril, V., Freeman, R., Malik, R.A., *et al.* (2016) Diabetic Neuropathy: A Position Statement by the American Diabetes Association. *Diabetes Care*, **40**, 136-154. https://doi.org/10.2337/dc16-2042

[42] Hamdaoui, M.S., Midoun, N. and Belhadj, M. (2023) Facteurs de risque de la neuropathie périphérique patente chez le diabétique de type 2 dans une population algérienne: Principaux déterminants. *Médecine des Maladies Métaboliques*, **17**, 586-593. https://doi.org/10.1016/j.mmm.2023.08.005

[43] Levitt Katz, L.E., White, N.H., El ghormli, L., Chan, C.L., Copeland, K.C., Lipman, T.H., *et al.* (2021) Risk Factors for Diabetic Peripheral Neuropathy in Adolescents and Young Adults with Type 2 Diabetes: Results from the TODAY Study. *Diabetes Care*, **45**, 1065-1072. https://doi.org/10.2337/dc21-1074

[44] Liu, X., Xu, Y., An, M. and Zeng, Q. (2019) The Risk Factors for Diabetic Peripheral Neuropathy: A Meta-Analysis. *PLOS ONE*, **14**, e0212574.

https://doi.org/10.1371/journal.pone.0212574

[45] Young, M.J., Boulton, A.J.M., Macleod, A.F., Williams, D.R.R. and Sonksen, P.H. (1993) A Multicentre Study of the Prevalence of Diabetic Peripheral Neuropathy in the United Kingdom Hospital Clinic Population. *Diabetologia*, **36**, 150-154. https://doi.org/10.1007/bf00400697

[46] Poitras, T.M., Munchrath, E. and Zochodne, D.W. (2021) Neurobiological Opportunities in Diabetic Polyneuropathy. *Neurotherapeutics*, **18**, 2303-2323. https://doi.org/10.1007/s13311-021-01138-y