

Peripheral Neuropathy and Associated Factors in Diabetics at the CNHU-HKM of Cotonou in 2021

Annelie Kerekou Hode, Hubert Dedjan, Fidodé Martine Sondjo

Endocrinology Teaching Unit, Faculty of Health Sciences of the University of Abomey-Calavi, Abomey-Calavi, Benin
Email: kerekouannelie@yahoo.fr

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Abstract

Diabetic peripheral neuropathy (DPN) is a common complication of diabetes. The main objective of the study was to determine the prevalence of diabetic peripheral neuropathy and associated factors in diabetics in the University Clinic of Endocrinology Metabolism Nutrition of the CNHU-HKM, Cotonou, Benin 2021. This was a cross-sectional, analytical study that ran from 23 September to 23 December 2021. Admitted diabetic patients seen in consultation during the study period were included. The DN4 tool was used as the basis for data collection. Data analysis was performed using R software version 3.6.1. Multivariate analysis was used to identify factors associated with DPN. Out of 155 diabetics, 54 patients had diabetic peripheral neuropathy, a prevalence of 34.8%. The average age of our patients was 56.8 years and 56.8% were female. Of the patients, 54.7% had unbalanced diabetes. An association between DPN and gender ($p = 0.022$), occupation ($p = 0.004$), education ($p = 0.011$), hypertension ($p = 0.017$), smoking ($p = 0.031$), diabetic imbalance ($p = 0.001$), diabetic retinopathy ($p = 0.020$) and dyslipidaemia ($p = 0.015$) was observed. DPN was also associated with erectile dysfunction in men ($p = 0.001$). **Conclusion:** Diabetic peripheral neuropathy is common (34.8). Its occurrence is indicative of the presence of associated factors.

Keywords

Diabetes, Diabetic Peripheral Neuropathy, DN4 Questionnaire, Associated Factors, Benin

1. Introduction

Diabetes, according to the World Health Organisation (WHO), “is a chronic

disease that occurs when the pancreas does not produce enough insulin or when the body is unable to use the insulin it produces effectively. The result is an increased concentration of glucose in the blood” [1]. Its prevalence varies between countries and ethnic groups. The condition is rapidly increasing in all countries of the world, particularly in developing countries. In Africa, 3.9% of adults aged 20 - 79 were living with diabetes in 2019. The largest increases will occur in developing countries [2] [3]. Between 2000 and 2016, according to WHO, premature mortality due to diabetes increased by 5% in these countries. Indeed, Benin is not spared from this epidemic trend. The prevalence of diabetes, which was 1.1% in 2001, doubled in 2008 (2.6%) according to the STEPS survey [4] and rose to 5.1% in 2016 [5]. The management of diabetes remains difficult in Africa, which exposes diabetics to multiple complications, particularly diabetic neuropathy, which has a high prevalence (8% to 60%) [6]. It is the most common complication, which can be responsible for trophic disorders in the foot leading to amputation, silent myocardial ischaemia (55% - 70% of deaths) [7], erectile dysfunction and other disorders causing discomfort in the daily life of patients. The present study was initiated to evaluate peripheral neuropathy and associated factors in diabetics at the Centre National Hospitalier Universitaire-Hubert Koutoukou MAGA (CNHU-HM) in Cotonou.

2. Study Methods

This was a cross-sectional and analytical study which took place during the period from 23 September to 23 December 2021 and involved diabetic patients followed up at the University Clinic of Endocrinology Metabolism Nutrition of the CNHU-HKM for the management of their diabetes. We did an exhaustive sampling. The study included diabetic patients who were seen in consultation or hospitalized at the University Clinic of Endocrinology Metabolism Nutrition of the CNHU-HKM during the study period; who gave their free and informed consent. Non-included patients were those with acute diabetic complications and those with other causes of neuropathy. The variables studied were age, sex, professional activity, education level. Hypertension, Diabetes duration, Diabetes control, Diabetes complications. We selected the DN4 screening questionnaire which is the most widely used. The collected data were exported from the Ko-boCollect® application into Excel version 2019 and analysed with the R software version 3.6.1. For comparisons, Pearson’s chi-2 test or Fisher’s exact test Student’s t-test was used. The threshold of statistical significance was 5%.

3. Results

At the end of our study, 155 patients were included.

Socio-demographic characteristics (**Table 1**).

The median age of the patients was 65 years with extremes ranging from 31 to 85 years and an interquartile range from 55 to 65 years. There were 88 (56.8%) female patients. The sex ratio (M/F) was 0.76. Retired patients were 37.4% and

employed patients 42.3%. In addition, about 42.6% of the patients had secondary education and 39.4% had higher education. Fons and relatives represented 51.6% of our sample (**Table 1**).

Clinical features

Hypertension was present in 71% (110) of the patients, stroke in 5.2% and dyslipidaemia also in 55.5% (86 patients). The frequency of patients who drank alcoholic beverages at least once a month was 16.1% (25 patients) and those who occasionally smoked was 3.2% (**Table 2**).

Type of diabetes, treatment, length of time and control of diabetes

All patients had type 2 diabetes and 58.7% of these patients had suffered from diabetes for more than 5 years. The majority of patients (90.3%) were being treated with oral antidiabetic drugs. Diabetes imbalance was found in 54.8% of the patients (**Table 3**).

Table 1. Socio-demographic characteristics of the patients surveyed. CNHU-HKM, Cotonou/Benin, 2021 (N = 155).

	n	%
Age (years)		
<40	04	2.6
≥40	151	97.4
Gender		
Male	67	43.2
Female	88	56.8
Ethnicity		
Fon and related	80	51.6
Goun and related	28	18.1
Adja and related	26	16.7
Yoruba and related	21	13.7
Profession		
Employee	64	41.3
Craftsman/Worker	6	3.9
Housekeeper	10	6.4
Reseller/Dealer	17	11.0
Retired	58	37.4
Level of education		
No	5	3.2
Primary	23	14.8
Secondary	66	42.6
Superior	61	39.4

Table 2. Distribution of patients according to history. CNHU-HKM, Cotonou/Benin, 2021 (N = 155).

	n	%
HTA		
Yes	110	71.0
No	45	29.0
Dyslipidemia		
Yes	86	55.5
No	69	44.5
Stroke		
Yes	8	5.2
No	147	94.8
Alcoholism		
Yes	25	16.1
No	130	83.9
Smoking		
Smoker	5	3.2
Non-smoker	150	96.8

Table 3. Distribution of patients according to type of diabetes, treatment, length of time and diabetes control. CNHU-HKM, Cotonou/Benin, 2021 (N = 155).

	N	%
Age of diabetes (years)		
<5	64	41.3
≥5	91	58.7
Type of diabetes		
Type 1	00	00
Type 2	155	100
Type of treatment		
ADO	140	90.3
Insulin	5	3.2
ADO + Insulin	10	6.5
Diabetes control		
HbA1c < 7%	70	45.2
HbA1c > 7%	85	54.8

ADO: Antidiabetic drugs; HbA1c: Glycated haemoglobin.

Anthropometric Measurements

Sixty-seven patients were overweight or 43.2% and 46 patients or 29.7% were obese. The average waist circumference of our patients was 93 cm. The majority of patients or 70.8% were abdominally obese.

Complications

All patients had a fundus examination. Of the patients, 20.6% had diabetic retinopathy. Erectile dysfunction was found in 7.1% of patients.

Prevalence of diabetic peripheral neuropathy (DPN)

Of the 155 patients surveyed, 54 had diabetic peripheral neuropathy, a prevalence of 34.8%. Factors associated with diabetic peripheral neuropathy.

Univariate analysis

Socio-demographic characteristics and diabetic peripheral neuropathy.

Clinical features and diabetic peripheral neuropathy.

► History and diabetic peripheral neuropathy

There was an association between high blood pressure ($p = 0.001$), dyslipidaemia ($p = 0.006$), smoking ($p = 0.031$) and the occurrence of diabetic peripheral neuropathy.

Obesity ($p = 0.196$), alcoholism ($p = 0.647$) and stroke ($p = 0.714$) were not associated with diabetic peripheral neuropathy (**Table 4**).

Table 4. Association between hypertension, stroke, obesity, dyslipidaemia, alcoholism, smoking and diabetic peripheral neuropathy. CNHU-HKM, Cotonou/Benin, 2021 (N = 155).

	n	DPN	OR	IC 95%	p-value	
	n	%				
HTA						
Yes	110	47	42.73	2.74	[1.34 - 5.61]	0.001
No	45	7	15.56	1.00		
STROKE						
Yes	8	2	25.00	1.00		
No	147	52	35.37	1.41	[0.41 - 4.79]	0.714
Obesity						
Yes	46	20	43.48	1.39	[0.90 - 2.14]	0.196
No	109	34	31.19	1.00		
Dyslipidemia						
Yes	86	38	44.2	1.47	[1.16 - 3.11]	0.006
No	69	16	23.2	1.00		
Alcoholism						
Yes	25	15	40.00	1.18	[0.69 - 2.02]	0.647
No	130	44	33.85	1.00		
Smoking						
Smoker	5	4	80.00	2.40	[1.46 - 3.93]	0.031
Nonsmoker	150	50	33.33	1.00		

► Type of treatment, length of time and imbalance of diabetes

Diabetes imbalance ($p = 0.000$) was associated with the occurrence of diabetic peripheral neuropathy.

Length of diabetes ($p = 0.609$) and type of treatment ($p = 0.095$) were not associated with diabetic peripheral neuropathy (**Table 5**).

► Complications

Erectile dysfunction ($p = 0.0002$) and diabetic retinopathy ($p = 0.0003$) were associated with diabetic peripheral neuropathy.

Multivariate analysis

Factors associated with DPN on multivariate analysis were gender (**Table 6**).

($p = 0.022$), hypertension ($p = 0.017$), dyslipidaemia ($p = 0.015$), diabetic imbalance ($p < 0.001$), diabetic retinopathy ($p = 0.020$) and erectile dysfunction ($p < 0.001$).

Diabetes imbalance, erectile dysfunction and diabetic retinopathy were associated with DPN on multivariate analysis were (**Table 7**).

4. Discussion

The prevalence of diabetic peripheral neuropathy among diabetics in our study was 34.84%. Several authors have reached a similar result. Fendi *et al.* 33.3% in Tunisia in 2011 [8], Aynaou *et al.* 43% in Morocco in 2019 [9], Doukpo *et al.* 47.6% in Benin in 2015 [10], Djibril *et al.* 43.2% in Mali in 2013 [11]. However, Boufaïda *et al.* in Morocco (2016) [12] and Mizouri *et al.* in Tunisia (2018) [13], reported lower prevalences of 17.5% and 8.6% respectively. This difference could be explained by the disparity of the criteria used.

Factors associated with diabetic peripheral neuropathy.

Table 5. Association between the type of treatment, the length of time and the imbalance of diabetes and diabetic peripheral neuropathy. CNHU-HKM, Cotonou/Benin, 2021.

	N		DPN	OR	IC 95%	p-value
	n		%			
Age of diabetes (years)						
<5	64	24	37.50	1.37	[0.73 - 1.75]	0.609
≥5	91	30	32.97	1.00		
Type of treatment						
ADO	140	47	33.57	1.11	[0.42 - 2.96]	0.095
Insulin	5	4	80.00	2.33	[0.83 - 6.53]	
ADO + Insulin	10	03	30.00	1.00		
Diabetes control						
HbA1c < 7%	70	14	20.00	1.00		
HbA1c > 7%	85	40	47.06	1.74	[1.04 - 2.91]	0.000

ADO: Oral antidiabetics, HbA1c.

Table 6. Study of factors associated with diabetic peripheral neuropathy in multivariate analysis. CNHU-HKM, Cotonou/Benin, 2021.

	Univariate analysis			Multivariate analysis		
	OR	IC 95%	p-value	OR	IC 95%	p-value
Gender						
Male	1.00		0.173	1.00		0.022
Female	2.40	0.88 - 2.22		3.99	1.28 - 1.42	
Profession						
Employee	1.35	0.76 - 2.41	0.004			
Craftsman/Worker	3.45	1.93 - 6.16				
Housekeeper	2.90	1.57 - 5.34				
Reseller/Dealer	1.70	0.82 - 3.53				
Retired	1.00	-				
Level of education						
No	3.38	2.29 - 4.99	0.011			
Primary	1.47	0.80 - 2.70				
Secondary	1.07	0.63 - 1.82				
Superior	1.0	-				
HTA						
Yes	2.74	1.34 - 5.61	0.001	3.36	1.29 - 9.38	0.017
No	1.00					
Obesity						
Yes	1.39	0.90 - 2.14	0.196			
No	1.00					
Dyslipidemia						
Yes	1.47	1.16 - 3.11	0.006	2.91	1.25 - 7.14	0.015
No	1.00					
Smoker						
Smoker	2.40	1.46 - 3.93	0.031			
Non-smoker	1.0					
Treatment						
ADO	1.11	0.42 - 2.96				
Insulin	2.33	0.83 - 6.53	0.095			
Insulin + ADO	1.00					

Gender was a factor statistically associated with diabetic peripheral neuropathy. Moreover, DPN was more frequent in women ($p = 0.022$). Aouiche *et al.* in Algeria (2014) [14], Fendi *et al.* in Tunisia (2011) [8] found the same association. On the other hand, in the study by Doukpo *et al.* in Benin (2015) [10] and that of Aynaou *et al.* in Morocco (2019) [9], a correlation between sex and diabetic peripheral neuropathy was not reported.

Table 7. Study of factors associated with diabetic peripheral neuropathy in multivariate analysis. CNHU-HKM, Cotonou/Benin, 2021.

	Univariate Analysis			Multivariate Analysis		
	OR	IC 95%	p-value	OR	IC 95%	p-value
Diabetes control						
Balance	1.00					
Imbalance	1.74	1.04 - 2.91	0.000	3.61	1.66 - 8.29	0.001
Erectile dysfunction						
Yes	3.00	2.19 - 4.10	0.0002	4.89	1.11 - 11.8	0.001
No	1.00					
Diabetic retinopathy						
Yes	2.26	1.52 - 3.34	0.0003	3.24	1.21 - 8.98	0.020
No	1.00					

Age was not a factor associated with DPN in our study. Boufaida *et al.* [12] made the same finding in 2016 in Morocco. On the other hand, AOUICHE *et al.* [14], and AYNAOU *et al.* [9] reported an association respectively in Algeria (2014) and Morocco (2019). This difference could be explained by the different sample size.

There was an overall association between occupation and the occurrence of diabetic peripheral neuropathy. The prevalence of diabetic peripheral neuropathy was lower among civil servants compared to craftsmen/workers and housewives. This finding could be explained by the fact that civil servants are generally well off and some of them have health insurance that allows them to better manage their diabetes than others.

Educational level was significantly related to diabetic peripheral neuropathy. The prevalence of DPN was higher in less educated patients (illiterate or primary). This could be explained by the fact that less educated patients are not always well informed about diabetes and are therefore more exposed to chronic complications including diabetic peripheral neuropathy.

This association between occupation and DPN, education level and DPN was also reported by the study of Doukpo *et al.* in Benin (2015) [10].

DPN is significantly associated with hypertension in some studies such as those of Boufaida *et al.*, Aouiche *et al.* and Tesfaye *et al.* conducted respectively in Morocco (2016), Algeria (2014) and sixteen (16) European countries (1995) [12] [14] [15], including ours where 42.73% of patients with diabetic peripheral neuropathy also had hypertension ($p = 0.001$).

An association between smoking and DPN was also found in our study. This result is similar to that of Tesfaye *et al.* in 1995 [15] and AL Mahroos *et al.* in Bahrain (2003) [16] who found an association.

We did not find an association between alcohol consumption and the occurrence of diabetic peripheral neuropathy. This may be explained by the sample

size.

Overweight (obesity) was not associated with diabetic peripheral neuropathy. Djibril *et al.* in 2013 in Mali [11] made the same observation. On the other hand, AL Mahroos *et al.* [16] found an association between excess weight and the occurrence of diabetic peripheral neuropathy in Bahrain in 2006. This difference can be explained by the small size of our sample.

Dyslipidemia is involved in the mechanism of nerve destruction that leads to diabetic peripheral neuropathy. Boufaïda *et al.* 2016 (Morocco) [12] and Lahmar *et al.* in 2017 (Morocco) [17] noted in their studies conducted in Morocco a significant relationship between dyslipidemia and the prevalence of diabetic peripheral neuropathy. Dyslipidemia ($p = 0.015$) is also associated with diabetic peripheral neuropathy in our study.

Diabetic imbalance was associated with diabetic peripheral neuropathy. This result is consistent with the literature. Indeed, in case of poor diabetic control, there is an increased production of AGEs which are involved in the occurrence of diabetic peripheral neuropathy. This result is similar to that reported by Aouiche *et al.* in Algeria, Al Mahroos *et al.* in Bahrain (2006), Boru *et al.* in Turkey (2007), Ugoya *et al.* Nigeria (2008) and Bouya *et al.* in Iran (2005) [14] [16] [18] [19] [20], where diabetic imbalance is associated with diabetic peripheral neuropathy. On the other hand, Doukpo *et al.* in 2015 in Benin [10] and Mahamane *et al.* in 2014 in Niger [21] had not reported an association. It has not been established that the risk of diabetic peripheral neuropathy increases with the age of diabetes. Similarly, Oueslati *et al.* [22] reached the same conclusion in 2018 in Tunisia. On the other hand, Al Mahroos *et al.* [16], Ugoya *et al.* [19], concluded that chronic complications of diabetes appear with the duration of diabetes respectively in Bahrain (2006) and Nigeria (2008).

Erectile dysfunction was associated with diabetic peripheral neuropathy ($p = 0.001$) and this result is similar to that reported by Mahamane *et al.* in 2014 in Niger [21].

Diabetic retinopathy was significantly related to diabetic peripheral neuropathy. Similarly Boufaïda *et al.*, Aynaou *et al.*, Ugoya *et al.*, and Mahamane *et al.* [9] [12] [19] [21] also made the same finding respectively in Morocco (2016), Morocco (2019), Nigeria (2008) and Niger (2014). This result is not surprising because diabetic retinopathy shares the same pathophysiological mechanism with diabetic peripheral neuropathy which is the increase of AGEs promoted by chronic hyperglycaemia.

5. Conclusion

At the end of this study which focused on diabetic peripheral neuropathy and associated factors in diabetics followed at the University Clinic of Endocrinology Metabolism Nutrition of the CNHU-HKM of Cotonou, Benin in 2021, it appears that the prevalence of diabetic peripheral neuropathy is high 34.84% in the diabetics included in the study. The factors associated with diabetic peripheral

neuropathy are: gender, occupation, level of education, arterial hypertension, dyslipidaemia, smoking, diabetic imbalance, erectile dysfunction, diabetic retinopathy. The determination of these risk factors is essential for the identification of patients at risk and better management.

Conflicts of Interest

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

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