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PREVALENCE AND ASSOCIATED FACTORS OF PERIPHERAL NEUROPATHY IN DIABETIC PATIENTS IN SAUDI ARABIA

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Abstract

Background: A serious microvascular diabetic complication is Diabetic Peripheral Neuropathy (DPN), which reduces quality of life and increases disability. Understanding the prevalence and associated factors of DPN is crucial in Saudi Arabia where diabetes mellitus (DM) prevalence is amongst the highest globally given that prevalence of DPN is highest in that country compared to other Middle Eastern countries.

Objective: The aim of this study was to find out the prevalence of DPN among diabetic patients in Saudi Arabia and to identify the contributory factors to its development.

Methods: A cross-sectional study was conducted from July to December 2024 managing 493 Saudi adults older than 18 years diagnosed with DM. For recruitment, participants came from several different cities, and a structured questionnaire was used to obtain information about demographics, diabetes history and symptoms of neuropathy. SPSS software was used for statistical analysis to analyze the correlation between DPN with different demographic and health related factors.

Results: The mean participant age was 50.5 years old, with 45.8% diabetes >10 years. We found that type 2 diabetes was significantly more common (55.0%). Of note, 50.3% of participants never experienced neuropathic pain, and 31.8% experienced occasional symptoms. Sensory loss was present in a significant proportion (14.2%) suggestive of possible neuropathy. There were statistically significant relationships between neuropathic symptoms and gender, age, weight, educational level and duration of diabetes ($P< 0.001$ for most factors). Even though they had good engagement in blood sugar monitoring (84.8%), 41.4% of participants had never received professional advice for the management of DPN.

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Conclusion: The results confirm the high prevalence of DPN in diabetic Saudi patients and identify significant associations with demographic or health related factors. Prompted from this study, the need for a greater awareness of DPN, and healthcare interventions to ameliorate it as effectively as possible has been highlighted, especially in populations which have prolonged diabetes duration and restricted access to professional healthcare. Efforts of education and early detection are needed in future DPN strategies to limit the impact on patient quality of life.

Keywords: Diabetic peripheral neuropathy, prevalence, risk factors, Saudi Arabia, diabetes mellitus.

Introduction:

Chronic hyperglycemia is a hallmark of the complicated metabolic disease known as diabetes mellitus (DM). Defects in insulin action, secretion, or both lead to disruptions in the metabolism of proteins, fats, and carbohydrates. Severe diabetic consequences, including retinopathy, neuropathy, nephropathy, cardiovascular problems, and ulceration, are brought on by the evolution of diabetes [1]. One of diabetes's most prevalent and serious microvascular side effects is diabetic peripheral neuropathy (DPN). As a primary cause of peripheral nerve injury, DPN lowers life quality and increases the likelihood of impairment in individuals with diabetes [2]. The term "peripheral neuropathy" refers to a wide spectrum of clinical disorders that may manifest as malfunctioning of the peripheral nerve system. Individuals suffering from peripheral neuropathy frequently exhibit discomfort, hyperalgesia, allodynia, tingling, aching, and burning sensations, as well as varied degrees of limb weakening. Different people have described this pain as deep-seated, acute, persistent, and worse at night [3].
(DPN) frequently goes undetected. A delayed diagnosis can result in increased mortality as well as severe morbidity, including painful DPN (pDPN), erectile dysfunction, diabetic foot ulceration (DFU), and amputation. The progression of DPN may be slowed down or prevented with early identification and treatment [4].
In Saudi Arabia, diabetes mellitus (DM) is among the most prevalent chronic illnesses. Based on a recent World Health Organization assessment, Saudi Arabia has the second-highest prevalence of diabetes mellitus (DM) in the Middle East and ranks seventh globally. Moreover, the prevalence of diabetes is increasing globally by 5% per year, according to the Centers for Disease Control and Prevention [5]. It has been claimed that the Middle East and North Africa have a 17–53% frequency of DPN.4. 5, 27, 32% in Europe 6, 7, 21, 45% in the USA 8, and 17–62% in China 9. DPN does not have an approved treatment.10. To postpone or stop the onset of DPN, it is essential to recognize and control the risk factors for the condition [6].
2019 saw 463 million adults between the ages of 20 and 79 with DM, and it is projected that by 2030, this figure will rise to 578 million [7]. By 2017, 39 million Africans were estimated to have diabetes; by 2045, that figure is expected to increase to 82 million [8]. Saudi Arabia was the second-highest country in the Middle East and the seventh-highest country globally in a recent World Health Organization assessment on the prevalence of diabetes mellitus [9]. Over 80% of deaths from diabetes, the seventh most common cause of mortality, take place in middle and low-income nations [10]. Patients with diabetes eventually acquire DN in at least 50% of cases. Type 1 diabetics benefit greatly from glucose management in slowing the progression of diabetic neuropathic pain (DN); type 2 diabetics, who make up the majority of the patient population, have less benefit from this intervention [11]. The incidence of DN in Saudi Arabia varied according on the areas that were investigated. According to a hospital-based study done in Riyadh, peripheral DN affects 69.2% of people with type 2 DM. 56% of the 237 DM patients in another prospective trial at King Abdulaziz University Hospital in Jeddah had

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symptomatic peripheral DN. According to a Qassim research, 38.2% of patients had DN [12]. According to reports, the incidence of amputation is 10–20 times higher in those with DPN compared to those without the disease. This condition results in the amputation of all or part of the lower limbs every 30 seconds, somewhere in the world [13].
Studies published in 2020 found many risk variables related to the development of DPN in Saudis. These must be considered in initiatives and campaigns aiming at reducing the risk of cardiovascular and chronic diseases, and hence the advancement of DPN [14].
In Saudi Arabia, the studies related to the prevalence of DPN are few. Therefore, this study sought at estimating the prevalence and associated factors of DPN in Saudi Arabian patients with diabetes mellitus.

Objectives:

This research sought to determine the prevalence of diabetic peripheral neuropathy (DPN) among individuals with diabetes in Saudi Arabia and uncover the associated factors contributing to its development within the Saudi population.

Methodology:

Study design and Setting:
This is a cross-sectional study conducted in Saudi Arabia from July to December 2024. The research involved Saudi adults over the age of 18, residing in various major cities across Saudi Arabia. Participants were recruited throughout the year 2024. Individuals under 18 years of age and non-Saudi residents were excluded from the study.

Sample size:
Dr. Pario Aldo's 2011 study (Masters' thesis, unpublished data) yielded the largest sample size for recurrence analysis. To estimate prevalence, use the Keish and Leslie formula (1965): N= Z2 P (1-P) / δ2. The required sample size is 288 with a 75% prevalence. In this equation, N is the sample size, Z is the standard normal deviation at 95% confidence (1.96), P is the estimated prevalence of 0.75, and δ2 is the precision (0.05).288 newly diagnosed diabetics were included in this investigation [15].

Inclusion and Exclusion criteria:
For inclusion in the study, all Saudi Arabian patients with diabetes mellitus were eligible.

Method for data collection, instrument and score system:
Research instruments include structured surveys. The questionnaire was developed after a careful review of related studies. Examination of relevant Saudi Arabian research, thirty were completed and categorized into the four main parts of the questionnaire. The first section of questions focused on features of socioeconomic backgrounds. Details related to general information about diabetes mellitus and prevalence are provided in the second part. Diabetic patients' knowledge towards peripheral neuropathy was conducted in the third portion, and an assessment of their awareness and attitude towards peripheral neuropathy was conducted in the fourth. A web-based survey was used by medical students to gather data.

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Pilot test:
The questionnaire was distributed to 20 individuals to complete. This was done to assess the simplicity of the questionnaire and the feasibility of the study. The data from this pilot study was excluded from the final analysis.

Analyzes and entry method:
The data was initially entered into the computer using Microsoft Office Excel Software (2021) for Windows. It was then transferred to SPSS software, version 20 (IBM SPSS Statistics for Windows, Version 20.0, Armonk, NY: IBM Corp.), for statistical analysis.

Results:

Table (1) displays various demographic parameters of the participants with a total number of (493). The participants mean age is 50.5 years old, with a large proportion (about 53.3 %) older than 51 years of age, suggesting a mature subject in which health outcome and lifestyle aspects may impact. At 57%, gender representation tilts to the male participants, and may represent the economic and social realities of the sampled population. The study was predominately composed of Saudi Nationals (98.4%) which would indicate a localized nature of this study and spread throughout the various regions (with 40% of them located in the Eastern region). The number of married participants (67.3 percent) is notably large and may have implications for how such structures of social support could exist in practice. This feature is manifested by the predisposition to higher education; 40.2% possess a bachelor's degree, indicative of a highly educated population; and in regard to income data, over 60% are between 5000 and 10000 SAR, illustrating economic stratification that makes these an ideal target to implement effective health interventions and social processes.

Table (1): Sociodemographic characteristics of participants (n=493)

Parameter		***No.***	***Percent (%)***
Age (Mean:50.5, STD:17.6)	35 or less	110	22.3
	36 to 50	140	28.4
	51 to 60	118	23.9
	More than 60	125	25.4
Gender	Female	212	43.0
	Male	281	57.0
Weight in kg (Mean:80.3, STD:17.7)	70 or less	150	30.4
	71 to 80	136	27.6
	81 to 90	127	25.8
	more than 90	80	16.2
Height in cm (Mean:164.2, STD:13.1)	155 cm or less	118	23.9
	156 to 169 cm	179	36.3
	170 cm or more	196	39.8
Nationality	Saudi	485	98.4
	Non-Saudi	8	1.6
Region of residence	Northern region	16	3.2
	Southern region	21	4.3
	Central region	103	20.9

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	Eastern region	197	40.0
	Western region	156	31.6
Marital status	Single	109	22.1
	Married	332	67.3
	Divorced	9	1.8
	Widowed	43	8.7
Educational level	Primary school	76	15.4
	Middle school	38	7.7
	High school	116	23.5
	Diploma	55	11.2
	Bachelor's degree	198	40.2
	Postgraduate degree	10	2.0
Monthly income in SAR	Less than 5000	148	30.0
	Between 5001 and 10000	152	30.8
	Between 10001 to 15000	94	19.1
	More than 15000	99	20.1
Occupational status	Student	38	7.7
	Employee	215	43.6
	Unemployed	123	24.9
	Freelancer	33	6.7
	Retired	84	17.0

As shown in figure 1, Significant information on glycemic control within the total sample of 493 individuals comes from the provided data on the levels of HbA1c among these individuals. Only 29.2% (144 individuals) have good control (HbA1c levels at or below 7%). On the contrary, the majority (53.1%, 262 individuals) fall within moderately controlled levels marked by HbA1c levels between 7% and 10%. Somehow, alarmingly, 17.6 percent (87 people) are determined to be in the poorly controlled group — an HbA1c greater than 10 percent.

Figure (1): Illustrates the HBA1C levels among participants.

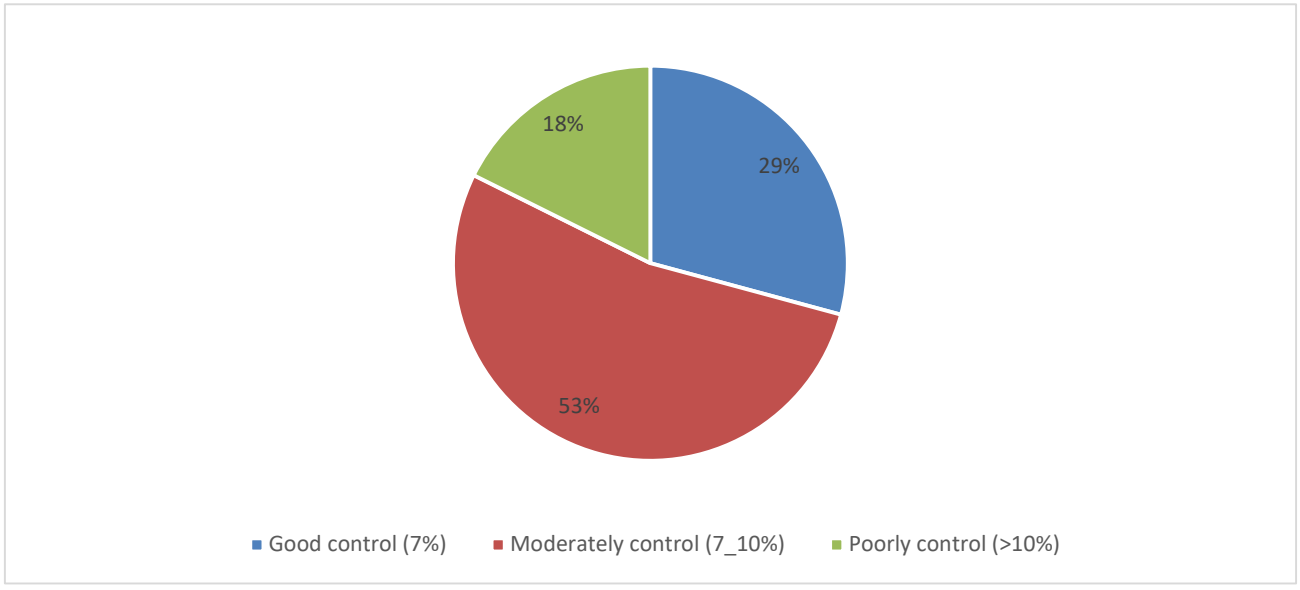

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Table 2 presents the data in comprehensive overview of the parameters associated with diabetes mellitus among a sample of 493 individuals. Of note, a major share of participants (45.8%) has been on with diabetes for more than 10 years, this means that diabetes is a chronic condition that calls for ongoing management and support. Type 2 diabetes (55.0%) is more common than Type 1 (45.0%) which is a blue trend seen in the population which experiences more Type 2 diabetes due to lifestyle factors. Treatment modalities show the use of mixed approach to the treatment of diabetes (insulin 45.4%; oral hypoglycaemic 41.4%). Also, 81.3 percent of the population with a family history of diabetes indicates a genetic predisposition that should be investigated further. Not only do they themselves emerge as critical components, as half of the participants (51.3%) report no exercise.

Table (2): Parameters related to general information about diabetes mellitus (n=493).

Parameter		***No.***	***Percent (%)***
When were you diagnosed with diabetes?	Less 1 year	80	16.2
	1 to 5 years	117	23.7
	6 to 10 years	70	14.2
	More than 10 years	226	45.8
What types of diabetes?	Type 1	222	45.0
	Type 2	271	55.0
What type of treatment are you using?	Insulin	224	45.4
	Oral hypoglycemia	204	41.4
	Diet	65	13.2
Do you have family history of D.M?	No	92	18.7
	Yes	401	81.3
Do you smoke?	No	364	73.8
	Yes	129	26.2
How often do you exercise per week?	Never	253	51.3
	1-2 times	163	33.1
	3-4 times	42	8.5
	5 or more times	35	7.1
Do you have a history of hypertension?	No	322	65.3
	Yes	171	34.7
HBA1C	Good control (7%)	144	29.2
	Moderately control (7_10%)	262	53.1
	Poorly control (>10%)	87	17.6

As shown in figure (2), Results from presented data show on foot sensitivity in the total sample of 493 respondents. Importantly, 46.7% (230 individuals) of participants said they do not have sensitivity to touch in their feet. This compares to the 33.5 percent (165 individuals) who indicated they occasionally were sensitive, which suggests that a large number of the public may suffer with episodic discomfort. In addition, 14.8% (73 subjects) reported foot sensitivity frequently, and another smaller segment, 5.1% (25 subjects), reported almost continuous sensitivity.

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Figure (2): Illustrates if the feet are sensitive to touch among participants.

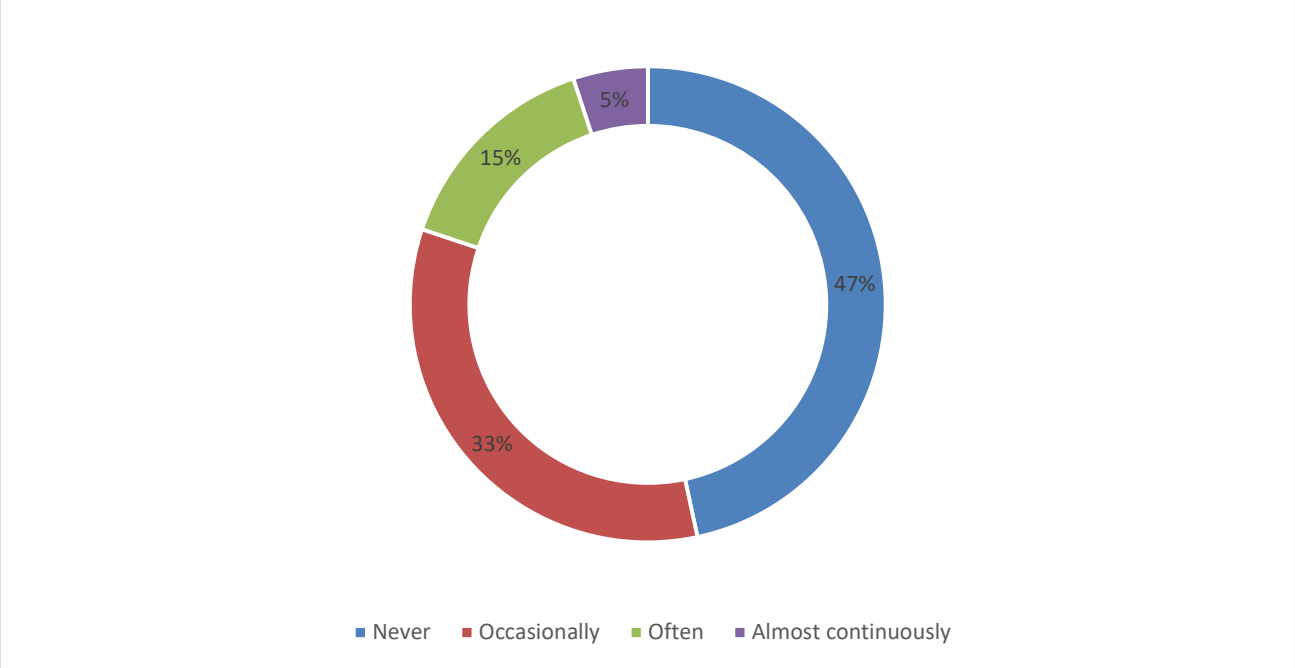

Table 3 presents survey results of diabetic patients about their knowledge and experience of diabetic neuropathy in Saudi Arabia with some amazing facts of prevalence and acknowledges facts of symptoms of diabetic neuropathy in the studied population of 493 people. Half (50.3%) had never had deep, aching, or tightness in their legs or feet and may therefore have been more aware or involved with their health care, limiting the frequency of neuropathic pain. However, as much as the data indicate that increasingly large numbers of patients experience symptoms during sequential treatment with a chemotherapy that is preceded, interspersed, or in between months that contain frequently progressing patients, there are also a highly significant proportion of patients who occasionally (31.8%) or experience symptoms frequently (9.3%). Furthermore, the tremendous majority of participants can detect temperature while bathing (97.6%) whereas 14.2% cannot detect feet while walking, suggesting troubling sensory deprivation that could encompass serious agony in case it goes unnoticed.

Table (3): Diabetic patients' knowledge towards peripheral neuropathy in Saudi Arabia (n=493).

Parameter		***No.***	***Percent (%)***
Do you experience deep, aching, tightness, boring, pulling, or squeezing pain in your feet or legs?	Never	248	50.3
	Occasionally	157	31.8
	Often	46	9.3
	Almost continuously	42	8.5
Do you experience unusual sensitivity or tenderness when your feet are touched or are used in activities such as walking?	Never	279	56.6
	Occasionally	114	23.1
	Often	50	10.1

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	Almost continuously	50	10.1
Do you experience burning pain in your feet or legs?	Never	281	57.0
	Occasionally	108	21.9
	Often	59	12.0
	Almost continuously	45	9.1
Do you experience sharp, stabbing, or shooting pain, electrical shock-like pain, or surges of pain that last seconds to minutes in your feet or legs?	Never	292	59.2
	Occasionally	117	23.7
	Often	46	9.3
	Almost continuously	38	7.7
Do you experience numbness, lost sensation, or a 'dead feeling' like an anesthetic, without prickling in your feet or legs?	Never	255	51.7
	Occasionally	146	29.6
	Often	55	11.2
	Almost continuously	37	7.5
Do you experience a prickling or tingling feeling, with or without an 'asleep' feeling, in your feet or legs?	Never	230	46.7
	Occasionally	148	30.0
	Often	74	15.0
	Almost continuously	41	8.3
Do you experience muscle cramps in your legs or feet?	Never	341	69.2
	Occasionally	74	15.0
	Often	25	5.1
	Almost continuously	53	10.8
Are your feet too sensitive to touch?	Never	230	46.7
	Occasionally	165	33.5
	Often	73	14.8
	Almost continuously	25	5.1
Are you able to tell the hot water from the cold water when in the bath or shower?	No	12	2.4
	Yes	481	97.6
Have you ever had an open sore on your foot?	No	456	92.5
	Yes	37	7.5
Do your legs hurt when you walk?	No	290	58.8
	Yes	203	41.2
Are you able to sense your feet when you walk?	No	70	14.2
	Yes	423	85.8
Is the skin on your feet so dry that it cracks open?	No	290	58.8
	Yes	203	41.2
Have you ever had an amputation?	No	489	99.2
	Yes	4	.8

Table 4 presents some important insights from data collected out of a sample (n = 493) of diabetic patients' awareness and attitudes towards peripheral neuropathy. Quite notably, respondents' level of engagement in daily personal health management is very high, as 84.8% of respondents stated they regularly check blood sugar. Nevertheless, 41.4 percent stated that they had not received advice from health care practitioners around managing their peripheral neuropathy, indicating that a further education may be requisite regarding this diabetes related complication. In addition, 71.6% of

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participants follow a specific dietary plan which indicates a positive lifestyle modification behavior.

Table (4): Diabetic patients' awareness and attitude towards peripheral neuropathy (n=493).

Parameter		***No.***	***Percent (%)***
Do you regularly monitor your blood sugar levels?	No	75	15.2
	Yes	418	84.8
How often do you visit your healthcare provider for diabetes management?	Monthly	44	8.9
	Every 3 months	216	43.8
	Every 6 months	102	20.7
	Annually	131	26.6
Have you been advised by your healthcare provider about managing peripheral neuropathy?	No	204	41.4
	Yes	289	58.6
Are you following any specific dietary plan?	No	140	28.4
	Yes	353	71.6

Table (5) shows that experiencing deep, aching, tightness, boring, pulling, or squeezing pain in the feet or legs has statistically significant relation to gender (P value=0.0001), age (P value=0.0001), weight (P value=0.0001), height (P value=0.0001), region of residence (P value=0.0001), marital status (P value=0.0001), educational level (P value=0.0001), monthly income (P value=0.0001), occupational status (P value=0.0001), time of diagnosis of diabetes (P value=0.0001), smoking (P value=0.0001), hypertension (P value=0.0001), and rate of physical activity (P value=0.015). It also shows statistically insignificant relation to nationality.

Table (5): Relation between experiencing deep, aching, tightness, boring, pulling, or squeezing pain in the feet or legs and sociodemographic characteristics.

Parameters		***Do you experience deep, aching, tightness, boring, pulling, or squeezing pain in your feet or legs?***		***Total (N=493)***	***P value****
		Never or occasional	**Often or always**		
Gender	Female	140	72	212	0.0001
		34.6%	81.8%	43.0%	
	Male	265	16	281	
		65.4%	18.2%	57.0%	
Age	35 or less	107	3	110	0.0001
		26.4%	3.4%	22.3%	
	36 to 50	132	8	140	
		32.6%	9.1%	28.4%	
	51 to 60	91	27	118	

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		22.5%	30.7%	23.9%	
	More than 60	75	50	125	
		18.5%	56.8%	25.4%	
Weight	70 or less	100	50	150	0.0001
		24.7%	56.8%	30.4%	
	71 to 80	126	10	136	
		31.1%	11.4%	27.6%	
	81 to 90	105	22	127	
		25.9%	25.0%	25.8%	
	more than 90	74	6	80	
		18.3%	6.8%	16.2%	
Height	155 cm or less	54	64	118	0.0001
		13.3%	72.7%	23.9%	
	156 to 169 cm	163	16	179	
		40.2%	18.2%	36.3%	
	170 cm or more	188	8	196	
		46.4%	9.1%	39.8%	
Nationality	Saudi	398	87	485	0.690
		98.3%	98.9%	98.4%	
	Non-Saudi	7	1	8	
		1.7%	1.1%	1.6%	
Region of residence	Northern region	11	5	16	0.0001
		2.7%	5.7%	3.2%	
	Southern region	3	18	21	
		0.7%	20.5%	4.3%	
	Central region	99	4	103	
		24.4%	4.5%	20.9%	
	Eastern region	189	8	197	
		46.7%	9.1%	40.0%	
	Western region	103	53	156	
		25.4%	60.2%	31.6%	
Marital status	Single	109	0	109	0.0001
		26.9%	0.0%	22.1%	
	Married	286	46	332	
		70.6%	52.3%	67.3%	
	Divorced	6	3	9	
		1.5%	3.4%	1.8%	
	Widowed	4	39	43	
		1.0%	44.3%	8.7%	
Educational level	Primary school	14	62	76	0.0001
		3.5%	70.5%	15.4%	
	Middle school	29	9	38	
		7.2%	10.2%	7.7%	
	High school	114	2	116	

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		28.1%	2.3%	23.5%	
	Diploma	52	3	55	
		12.8%	3.4%	11.2%	
	Bachelor's degree	189	9	198	
		46.7%	10.2%	40.2%	
	Postgraduate degree	7	3	10	
		1.7%	3.4%	2.0%	
Monthly income in SAR	Less than 5000	80	68	148	0.0001
		19.8%	77.3%	30.0%	
	Between 5001 and 10000	146	6	152	
		36.0%	6.8%	30.8%	
	Between 10001 to 15000	90	4	94	
		22.2%	4.5%	19.1%	
	More than 15000	89	10	99	
		22.0%	11.4%	20.1%	
Occupational status	Student	37	1	38	0.0001
		9.1%	1.1%	7.7%	
	Employee	209	6	215	
		51.6%	6.8%	43.6%	
	Unemployed	59	64	123	
		14.6%	72.7%	24.9%	
	Freelancer	25	8	33	
		6.2%	9.1%	6.7%	
	Retired	75	9	84	
		18.5%	10.2%	17.0%	
When were you diagnosed with diabetes?	Less 1 year	76	4	80	0.0001
		18.8%	4.5%	16.2%	
	1 to 5 years	113	4	117	
		27.9%	4.5%	23.7%	
	6 to 10 years	61	9	70	
		15.1%	10.2%	14.2%	
	More than 10 years	155	71	226	
		38.3%	80.7%	45.8%	
Smoking	No	280	84	364	0.0001
		69.1%	95.5%	73.8%	
	Yes	125	4	129	
		30.9%	4.5%	26.2%	
Rate of physical activity	Never	196	57	253	0.015
		48.4%	64.8%	51.3%	
	1-2 times	144	19	163	
		35.6%	21.6%	33.1%	
	3-4 times	33	9	42	
		8.1%	10.2%	8.5%	
	5 or more times	32	3	35	

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		7.9%	3.4%	7.1%	
Hypertension	No	311	11	322	0.0001
		76.8%	12.5%	65.3%	
	Yes	94	77	171	
		23.2%	87.5%	34.7%	

P value was considered significant if ≤ 0.05.

Table (6) shows that experiencing deep, aching, tightness, boring, pulling, or squeezing pain in the feet or legs has statistically significant relation to gender (P value=0.010), age (P value=0.0001), weight (P value=0.0001), height (P value=0.0001), region of residence (P value=0.0001), marital status (P value=0.0001), educational level (P value=0.0001), monthly income (P value=0.0001), occupational status (P value=0.0001), time of diagnosis of diabetes (P value=0.0001), smoking (P value=0.0001), hypertension (P value=0.0001), and rate of physical activity (P value=0.0001). It also shows statistically insignificant relation to nationality.

Table (6): Feel the feet when walking in association with sociodemographic characteristics.

Parameters		***Feel your feet when walking***		***Total (N=493)***	***P value****
		No	**Yes**		
Gender	Female	40	172	212	0.010
		57.1%	40.7%	43.0%	
	Male	30	251	281	
		42.9%	59.3%	57.0%	
Age	35 or less	12	98	110	0.0001
		17.1%	23.2%	22.3%	
	36 to 50	2	138	140	
		2.9%	32.6%	28.4%	
	51 to 60	3	115	118	
		4.3%	27.2%	23.9%	
	More than 60	53	72	125	
		75.7%	17.0%	25.4%	
Weight	70 or less	36	114	150	0.0001
		51.4%	27.0%	30.4%	
	71 to 80	9	127	136	
		12.9%	30.0%	27.6%	
	81 to 90	21	106	127	
		30.0%	25.1%	25.8%	
	more than 90	4	76	80	
		5.7%	18.0%	16.2%	
Height	155 cm or less	46	72	118	0.0001
		65.7%	17.0%	23.9%	
	156 to 169 cm	12	167	179	

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		17.1%	39.5%	36.3%	
	170 cm or more	12	184	196	
		17.1%	43.5%	39.8%	
Nationality	Saudi	70	415	485	0.246
		100.0%	98.1%	98.4%	
	Non-Saudi	0	8	8	
		0.0%	1.9%	1.6%	
Region of residence	Northern region	1	15	16	0.0001
		1.4%	3.5%	3.2%	
	Southern region	16	5	21	
		22.9%	1.2%	4.3%	
	Central region	1	102	103	
		1.4%	24.1%	20.9%	
	Eastern region	16	181	197	
		22.9%	42.8%	40.0%	
	Western region	36	120	156	
		51.4%	28.4%	31.6%	
Marital status	Single	8	101	109	0.0001
		11.4%	23.9%	22.1%	
	Married	28	304	332	
		40.0%	71.9%	67.3%	
	Divorced	0	9	9	
		0.0%	2.1%	1.8%	
	Widowed	34	9	43	
		48.6%	2.1%	8.7%	
Educational level	Primary school	35	41	76	0.0001
		50.0%	9.7%	15.4%	
	Middle school	18	20	38	
		25.7%	4.7%	7.7%	
	High school	9	107	116	
		12.9%	25.3%	23.5%	
	Diploma	0	55	55	
		0.0%	13.0%	11.2%	
	Bachelor’s degree	7	191	198	
		10.0%	45.2%	40.2%	
	Postgraduate degree	1	9	10	
		1.4%	2.1%	2.0%	
Monthly income in SAR	Less than 5000	50	98	148	0.0001
		71.4%	23.2%	30.0%	
	Between 5001 and 10000	13	139	152	
		18.6%	32.9%	30.8%	
	Between 10001 to 15000	3	91	94	
		4.3%	21.5%	19.1%	
	More than 15000	4	95	99	

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		5.7%	22.5%	20.1%	
Occupational status	Student	10	28	38	0.0001
		14.3%	6.6%	7.7%	
	Employee	3	212	215	
		4.3%	50.1%	43.6%	
	Unemployed	35	88	123	
		50.0%	20.8%	24.9%	
	Freelancer	17	16	33	
		24.3%	3.8%	6.7%	
	Retired	5	79	84	
		7.1%	18.7%	17.0%	
When were you diagnosed with diabetes?	Less 1 year	3	77	80	0.0001
		4.3%	18.2%	16.2%	
	1 to 5 years	2	115	117	
		2.9%	27.2%	23.7%	
	6 to 10 years	14	56	70	
		20.0%	13.2%	14.2%	
	More than 10 years	51	175	226	
		72.9%	41.4%	45.8%	
Smoking	No	64	300	364	0.0001
		91.4%	70.9%	73.8%	
	Yes	6	123	129	
		8.6%	29.1%	26.2%	
Rate of physical activity	Never	57	196	253	0.0001
		81.4%	46.3%	51.3%	
	1-2 times	8	155	163	
		11.4%	36.6%	33.1%	
	3-4 times	4	38	42	
		5.7%	9.0%	8.5%	
	5 or more times	1	34	35	
		1.4%	8.0%	7.1%	
Hypertension	No	15	307	322	0.0001
		21.4%	72.6%	65.3%	
	Yes	55	116	171	
		78.6%	27.4%	34.7%	

****P value was considered significant if ≤ 0.05.***

Discussion:

Diabetes mellitus is a common public health problem. About as many as 451 million persons worldwide were diagnosed with diabetes in 2017, and projections suggest numbers could increase to 693 million by 2045 [16]. Rates of mortality, morbidity, disability and financial strain related to the complications of diabetes are higher than other chronic illnesses. Diabetic peripheral neuropathy (DPN) is particularly an important microvascular complication of diabetes among the most frequent and serious [17].

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Peripheral nerve injury, including DPN, is a significant cause of compromising quality of life and increases risk of disability in those with diabetes. Despite this, it is not yet well understood what the global prevalence and risk factors for DPN are, particularly in low- and middle-income nations. Some 40–50% of those who develop DPN will experience painful DPN [18]. Type 2 diabetes mellitus patients with neuropathy and neuropathic pain have significantly worse health related quality of life. In addition, proper foot care for individuals with type 2 diabetes mellitus, and management of neuropathy, makes a considerable contribution to the economic burden on national healthcare systems. It has already been reported in prior research a very wide variation in the DPN prevalence, which has been from 8 to 75 % in diabetic patients [19]. Although there hasn't been a systematic study of the prevalence and related risk factors for diabetes-associated DPN in adults across different countries. Thus, we aimed in this study to determine the prevalence of diabetic peripheral neuropathy (DPN) among individuals with diabetes in Saudi Arabia and uncover the associated factors contributing to its development within the Saudi population.

Our research revealed that a large number of participants (45.8%) had diabetes of greater than 10 years duration, with diabetes Type 2 (55.0%) being more common than diabetes Type 1 (45.0%). The prevalence rate of diabetic peripheral peripheral neuropathy (DPN) as reported by previous studies varies from 9.6% to 78% in different populations [20, 21–22], which is comparable with this. Specifically, the DPN prevalence in our study was not noted but a relatively high percentage of participants had long standing diabetes, which indicates an elevated risk for neuropathy as is seen in studies that show longer duration of diabetes to be a major risk factor for DPN [23,24]. the prevalence of DPN in Type 2 diabetes patients was reported at 19.5% by Pradeepa et al. [25] and 14.4% by Rani et al. [26], which are lower than the prevalence rates typically observed in populations with a longer duration of diabetes. Our study found that while a majority (81.3%) had a family history of diabetes, indicating a genetic predisposition, over half (51.3%) reported no physical exercise, mirroring findings that lifestyle factors significantly contribute to the development of DPN [25, 27,28].

What is interesting is that we discovered that 50.3 % of participants never had leg or feet pain at all, and a minority had almost pain (31.8 %) or having pain (9.3 %). In contrast to the publication reporting higher rate of painful DPN (PDPN), aged and duration of diabetes were reported to be increasing risk factors for PDPN [29]. We found that 14.2% of participants were unable to feel their feet while walking, a measurement indicative of sensory loss, and a critical neuropathy severity marker. This is consistent with a recent prospective study that showed a substantial group of diabetic patients with moderate to severe neuropathy to be at an increased risk for foot ulcers and amputation [21]. The present study also revealed a good correlation between the demographic parameters including gender, age, weight and lifestyle habits with the neuropathic pain. Some studies have linked a sex specific predisposition to DPN, with women being more affected in some populations (30) but our findings did not show significant sex differences in neuropathy prevalence which agrees with studies by Gregersen et al [31] and Kamenov et al [32] who also found that DPN onset was not associated with sex. In addition, we found that only 84.8 percent of participants checked their blood sugar levels when they felt their blood sugar levels were outside the range recommended by their doctor, but an alarming 41.4 percent had not been advised professionally about how to manage peripheral neuropathy. In line with studies from developing countries, we found that socioeconomic factors such as lack of healthcare awareness and access to management resources are associated with diabetes management and its complications [32]. As shown by the present study, two-third of the participants with DPN belongs to low socioeconomic class; hence highlighting the need for better healthcare awareness and facilities to effectively manage

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diabetes in those populations.

Conclusion:

This study concludes with a very high prevalence of diabetic peripheral neuropathy (DPN) among diabetic patients in Saudi Arabia, especially those with longer duration of diabetes. Our results show that of those individuals, 45.8% had diabetes for more than 10 years, and Type 2 diabetes was more frequent. Of note, a large majority of patients had limited symptoms of neuropathic pain; however, a concerning proportion also experienced sensory loss, which could well result in major complications, including foot ulcers and amputations. Results of the study identified demographic and lifestyle factors that are critical to DPN, including age, weight, and physical inactivity. In spite of the high degree of self-monitoring of blood glucose, a large number of participants were not given professional guidance on neuropathy management. This highlights the salience of delivered and accessed quality and effective healthcare education and resources for good diabetes management. This gap in finding can help alleviate the burden of DPN and enhance diabetic patients' quality of life in Saudi Arabia.

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Ethical approval:

After fully explaining the study and emphasizing that participation is optional, each participant gave their informed consent. The information gathered was safely stored and utilized exclusively for study.

Funding:

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Conflict of interests:

The authors declare no conflict of interest.

Informed consent:

Written informed consent was acquired from each individual study participant.

Data and materials availability:

All data associated with this study are present in the paper.

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