Awareness regarding diabetic peripheral neuropathy and its risk factors among diabetics in Muhayil City, Saudi Arabia

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Abstract

Objectives: To assess the level of awareness regarding diabetic peripheral neuropathy (DPN) and its risk factors among diabetics in Muhayil City, Aseer Region, Saudi Arabia.

Subjects and Methods: A cross-sectional study was conducted from June to November 2020 in primary health care centers, Muhayil City, Saudi Arabia. Data were collected using an Arabic Language interview questionnaire, which included patient's demographics, in addition to awareness and knowledge items about DPN and its risk factors.

Results: This study included 367 diabetic patients. Their mean± SD age was 59±12 years. The mean±SD of diabetes duration was 8±5 years. Regarding participants' awareness grades about diabetes and its risk factors, 4.1%, 18.5%, and 77.4% had excellent, acceptable, and poor awareness levels, respectively. Prevalence of DPN was 10.1% based on the history part of the Michigan neuropathy screening instrument, and 12.3% based on the examination part of the Michigan neuropathy screening instrument.

Conclusions: Type 2 diabetic patients in Muhayil City have poor awareness about DPN and its risk factors. However, prevalence of DPN among them is relatively low.

Key words: Diabetes mellitus, diabetic peripheral neuropathy, awareness, Saudi Arabia.

Introduction

Diabetes mellitus (DM) is a chronic metabolic disease. It is characterized by elevated levels of blood glucose, which lead over time to serious complications, of which diabetic neuropathy is the most common complication (1-2).

Diabetic neuropathy is one of the most common long-term complications of diabetes and is the main initiating factor for foot ulceration, Charcot neuroarthropathy, and lower-extremity amputation (3). It is defined by the International Consensus Guidelines as: "the presence of symptoms and/or signs of peripheral nerve dysfunction in people with diabetes after exclusion of other causes" (4). In order to manage the serious complications of diabetes, it was recommended to screen for diabetic neuropathy at diagnosis and then every year afterwards (5).

Several studies from different parts of the world revealed that prevalence of diabetic peripheral neuropathy (DPN) was very high and ranged from 36.6%, in U.S. to 20% in the Middle-Eastern region (6). Among Saudi patients, after more than 10-years of diabetes, neuropathy prevalence was reported as high as 82%. Diabetic patients can play a vital role in early identification and reporting peripheral diabetic neuropathy to their physicians if they are aware about it. Despite that data on awareness about diabetic nephropathy in Saudi Arabia are scarce (7-8).

This study aimed to assess the level of awareness regarding diabetic peripheral neuropathy and its risk factors among diabetics in Muhayil City, Aseer Region, Saudi Arabia.

Methodology

This study was conducted during the period between June and November 2020. In Muhayil City, there are 26 primary health care centers serving 5612 diabetic patients.

Our sample size needed was calculated according to the Raosoft Sample Size Calculator (9) website to be 360 patients, with 5% error margin, 95% confidence level, 5,612 population size and 50% response distribution.

A simple random sampling technique was followed to select three primary healthcare centers with a total number of registered diabetic patients more than 400. Participant patients were interviewed and examined at the Chronic Diseases clinics of selected primary healthcare centers.

For data collection, the researchers used an interview questionnaire that has been developed by the researchers. It includes the following parts (in a simple Arabic language):

- **Personal characteristics:** age, sex, nationality, job, marital state, education level, smoking status, height, weight and Body Mass index.
- **Present history of diabetes:** Duration, types of received medications, last three readings of fasting blood glucose, and HbA1c.
- **Associated chronic diseases:** hypertension, ischemic heart disease, hyperlipidemia and renal disease.
- **Awareness items regarding DPN and its risk factors:** The researchers adopted a questionnaire that was adopted from the Canadian Diabetes Association about DPN (5). It comprised eight multiple choice questions that assess patients' awareness of DPN and its risk factors. A correct answer was assigned (1) point. The total score was 22 points. Accordingly, participants' total level of awareness was classified into 3 categories: "Poor" for patients who attained ≤60%, "Acceptable" for patients who attained 61%-79%, and "Excellent" for patients who attained ≥80%.
- **Screening for DPN:** This was done by using the validated Michigan Neuropathy Screening Instrument (10).

The Statistical Package for Social Sciences (IBM, SPSS version 25.0) was used for data entry and analysis. Descriptive statistics were calculated using frequency and percentage for qualitative variables, or mean and standard deviation for quantitative variables.

All necessary official and ethical approvals and permissions were fully secured before data collection. Collected data were kept strictly confidential and were used only for research purposes. The ethical approval of this study was obtained from the Ethical Committee of Scientific Research in King Khalid University (ECM#2019-104)—(HAPO-06-B-001) and was obtained on 25/12/2019.

Results

A total of 367 type 2 diabetic patients were enrolled in the present study. Table 1 shows that the mean±SD of participants' age was 59±12 years, with dominancy of the age group of 41-70 years old, which represented 278 (76%) of all participants. Males were slightly more than females (217, 59.1%, vs. 150, 40.9%, respectively). The majority were Saudi (361, 98.4%), and the largest proportion of patients were housewives (144, 39.2%). The most predominant education level was intermediate education (114, 31%), while 15.5% were current smokers.

Table 2 shows that the mean duration of diabetes mellitus was 8±5 years. Almost half of patients (45%) reported a disease duration between 6-12 years. Almost all patients were treated with metformin (365, 99.5%), followed by sulfonylureas (230, 62.7%) and DPP4 inhibitors (224, 61%). Hypertension was the most common comorbidity among patients (225, 61%), while 52.3% were obese. Regarding diabetes control, fasting blood sugar was <130 mg/dL in 18% of patients, while HbA1c was <7% in 3.5% of patients.

Table 3 shows that only 17.2% knew about DPN. Burning and tingling were the most frequently stated DPN symptoms (70% and 61%, respectively), while throbbing, and not feeling pain or hot/cold feet were the least stated (16.3% and 9.3%, respectively). High blood glucose levels were the most frequently stated risk factor for DPN (80.4%), while the least stated were high blood pressure and

elevated triglycerides (24.5% and 29.7%, respectively). Foot ulcers and missing minor cuts and sores were the most frequently stated complications of DPN (71.7% each), while amputation was the least frequently stated (56.7%). Most participants stated that DPN is diagnosed radiologically (62.7%), while 23.7% stated that it is diagnosed by special clinical tests. All participants stated that DPN can be prevented by proper foot care and strict blood glucose control. Only 11.2% stated that there are certain medications that decrease DPN pain.

Figure 1 demonstrates the patients' awareness levels about DPN, with 4.1% having an excellent grade of awareness, 18.5% having an acceptable grade, and 77.4% having a poor grade.

Table 4 shows that the participants' awareness grades did not differ significantly according to their diabetes control.

Table 5 shows that the prevalence of peripheral neuropathy among the diabetic patients was (10.1%) as indicated by using the history part of the Michigan Neuropathy Screening Instrument (MNSI).

Table 6 shows that the prevalence of peripheral neuropathy among the diabetic patients was (12.3%) among 45 patients by using the examination part of the Michigan Neuropathy Screening Instrument (MNSI).

Table 1: Diabetics demographic characteristics in Muhayil City, Aseer region, 2020, (n=367)

Sociodemographic Characteristics	No.	%
Age (Years):		
• ≤40	30	8.2
• 41-70	278	75.7
• ≥71	59	16.1
• Mean±SD	59.0±12.0	
Gender:		
• Male	217	59.1
• Female	150	40.9
Nationality:		
• Saudi	361	98.4
• Non-Saudi	6	1.6
Job:		
• Housewife	144	39.2
• Retired	133	36.2
• Teacher	23	6.3
• Military	8	2.2
• Other	51	13.9
• Unemployed	8	2.2
Education level		
• Illiterate	90	24.5
• Primary	36	9.8
• Intermediate	114	31.0
• Secondary	73	19.9
• University	54	14.7
Current smokers	57	15.5

Table 2: Diabetic patients' clinical characteristics in Muhayil City, Aseer region, 2020, (n=367)

Clinical Characteristics	No.	%
Duration of diabetes (in years):		
• ≤1	26	7.1
• 2 –5	111	30.2
• 6 –12	165	45.0
• ≥13	65	17.7
• Mean±SD	8.0±5.0	
Received medications:		
• Metformin	365	99.5
• Sulfonylureas	230	62.7
• DPP4 inhibitors	224	61.0
• Insulin glargine	75	20.4
• Humalog or Mixtard insulin	48	13.1
• Medications for foot pain	41	11.2
• Other Medications	20	5.4
Comorbidity:		
• Hypertension	225	61.3
• Cardiovascular disease	33	9.0
• Dyslipidemia	181	49.3
• Kidney disease	2	0.5
Obesity:		
• Overweight (BMI 25 to 29.9)	154	42.0
• Obesity class I (BMI 30 to 34.9)	192	52.3
• Obesity class II (BMI 35 to 39.9)	15	4.1
• Obesity class III (BMI ≥40)	3	0.8
Fasting blood sugar:		
• Controlled (≤130 mg/dL)	66	18.0
• Uncontrolled (≥131 mg/dL)	262	71.4
• Missing data	40	10.9
Glycated hemoglobin (HbA1c):		
• Control (≤7%)	13	3.5
• Uncontrolled (>7%)	118	32.2
• Missing data	236	64.3

Table 3: Knowledge of diabetic patients regarding diabetic peripheral neuropathy (DPN) and its risk factors in Muhayil City, Aseer Region, 2020, (n=367)

Knowledge items	Yes		No		Do not know	
	No.	%	No.	%	No.	%
Do you know what is DPN?	63	17.2	252	68.7	52	14.2
Exposure to high blood glucose levels over an extended period of time cause damage to peripheral nerves	149	40.6	96	26.2	122	33.2
Symptoms of DPN in the toes and feet:						
• Sharp, shooting pain	146	39.8	80	21.8	141	38.4
• Burning	257	70.0	80	21.8	30	8.2
• Tingling	224	61.0	66	18.0	77	21.0
• Pin pricked	135	36.8	118	32.2	114	31.1
• Throbbing	60	16.3	153	41.7	154	42.0
• Not feeling pain or hot/cold feet	34	9.3	88	24.0	245	66.8
Risk factors for DPN:						
• High blood glucose levels	295	80.4	27	7.4	45	12.3
• Elevated triglycerides	109	29.7	124	33.8	134	36.5
• Excess body weight	124	33.8	123	33.5	120	32.7
• Smoking	220	59.9	52	14.2	95	25.9
• High blood pressure	90	24.5	133	36.2	144	39.2
Complications of DPN:						
• Foot ulcers	263	71.7	20	5.4	84	22.9
• Not noticing minor cuts and sores	263	71.7	31	8.4	73	19.9
• Wounds infections and gangrene	244	66.5	44	12.0	79	21.5
• Amputation	208	56.7	30	8.2	129	35.1
	Radiological		Special clinical tests		Do not know	
	No.	%	No.	%	No.	%
How to diagnose diabetic peripheral neuropathy?	230	62.7	87	23.7	50	13.6
	Yes		No		Do not know	
How to prevent complications of DPN?	No.	%	No.	%	No.	%
• Proper foot care	367	100.0	0	0.0	0	0.0
• Strict blood glucose control	367	100.0	0	0.0	0	0.0
• Control risk factors	177	48.2	40	10.9	150	40.9
Are there certain medications that decrease DPN pain?	41	11.2	168	45.8	158	43.1

Figure 1: Participants' grades of awareness about diabetic peripheral neuropathy

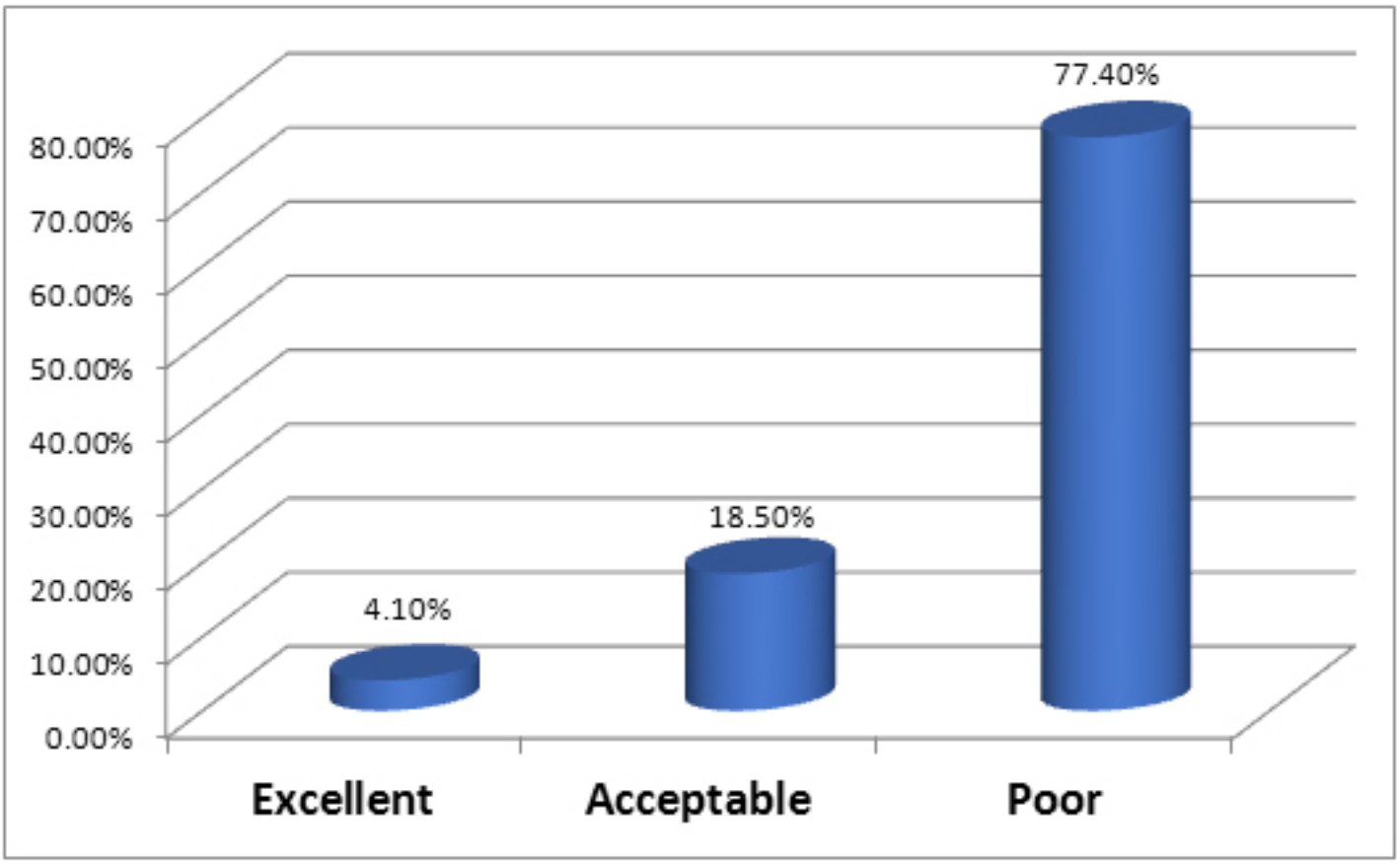

Table 4: The association between participants' diabetes control and their awareness grades regarding diabetic peripheral neuropathy

Awareness Grades	Controlled (HbA1c ≤7)	Uncontrolled (HbA1c >7)	P-value
Excellent	0 (0%)	7 (100%)	
Acceptable	1 (5.3%)	18 (94.7%)	0.473
Poor	12 (11.4%)	93 (88.6%)	

Table 5: Assessment of peripheral neuropathy in diabetic patients using history part of Michigan Neuropathy Screening Instrument

Questions	Yes		No	
	No.	%	No.	%
Are your legs and/or feet numb?	80	21.8	287	78.2
Do you ever have any burning pain in your legs and/or feet?	183	49.9	184	50.1
Are your feet too sensitive to touch?	28	7.6	339	92.4
Do you get muscle cramps in your legs and/or feet?	193	52.6	174	47.4
Do you ever have any prickling feelings in your legs or feet?	108	29.4	259	70.6
Does it hurt when the bed covers touch your skin?	38	10.4	329	89.6
When you get into the tub or shower, are you able to tell the hot water from the cold water?	353	96.2	14	3.8
Have you ever had an open sore on your foot?	221	60.2	146	39.8
Has your doctor ever told you that you have diabetic neuropathy?	25	6.8	340	92.6
Do you feel weak all over most of the time?	247	67.3	120	32.7
Are your symptoms worse at night?	118	32.2	249	67.8
Do your legs hurt when you walk?	35	9.5	332	90.5
Are you able to sense your feet when you walk?	358	97.5	9	2.5
Is the skin on your feet so dry that it cracks open?	29	7.9	338	92.1
Have you ever had an amputation?	1	0.3	366	99.7

Results	No.	%
• Positive (≥7)	37	10.1%
• Negative (≤6)	330	89.9%
Total	367	100.0%

Table 6: Assessment of peripheral neuropathy in diabetic patients using examinations part of Michigan Neuropathy Screening Instrument

	Findings					
Assessment	Normal		Abnormal			
Appearance of Feet:	No.	%	No.		%	
• Right	358	97.5	9		2.5	
• Left	360	98.1	7		1.9	
Ulceration:	Absent		present			
• Right	362	98.6	5		1.4	
• Left	367	100.0	0		0.0	
	Present		Reinforcement		absent	
Ankle Reflexes:	No.	%	No.	%	No.	%
• Right	356	97.0	10	2.7	1	0.3
• Left	354	96.5	13	3.5	0	0.0
Vibration at great toe:	Present		Decreased		Absent	
• Right	288	78.5	49	13.4	30	8.2
• Left	289	78.7	47	12.8	31	8.4
Monofilament:	Normal		Reduced		Absent	
• Right	202	55.0	117.0	31.9	48	13.1
• Left	199	54.2	116	31.6	52	14.2

Results	No.	%
• Positive (≥2.5)	45	12.3
• Negative (≤2)	322	87.7
Total	367	100.0

Discussion

Saudi Arabia is the second highest country in the Middle East and the seventh globally for rating diabetes according to the World Health Organization (WHO) (11). Diabetic peripheral neuropathy is a common complication in diabetic patients (12).

We aimed to investigate the awareness of diabetic patients regarding peripheral neuropathy and its risk factors.

Our patients' awareness about peripheral neuropathy was excellent among very few patients (4.1%), whereas the largest proportion (77.4%) had poor knowledge, and acceptable knowledge was found among 18.5% of patients. There was no significant difference between the knowledge of patients with controlled HbA1c and those with uncontrolled HbA1c.

Our results are in accordance with those of Alhashim et al. (13) in Al-Ahsa, Saudi Arabia, who found that only 7.2% of patients had high awareness, whereas 54.6% were not aware of DPN. Their patients' level of awareness differed significantly between patients who received health education about DPN by their healthcare providers and those who did not.

These findings confirm the importance of providing health education to diabetic patients regarding DPN and emphasizes the role of health education in increasing the level of awareness about DPN.

The diagnosis of DPN among our patients was based on both the history and examination parts of the Michigan neuropathy screening instrument (MNSI). The prevalence of peripheral neuropathy was 10.1%, 12.3% according to history and the examination respectively. The examination of the patients showed that 4.4% had abnormal appearance of feet and the most affected feet were the right feet. Ulceration was found among 1.4% of the patients, and all reported ulcers were in the right leg. The majority of participants had ankle reflexes, and most of the patients reported vibration sense at the great toe.

Higher prevalence of DPN was reported by several studies in Saudi Arabia. A study from primary care centers in Riyadh City showed that 35% of diabetic patients suffered from DPN (3). Another study reported a prevalence of 30.1% (14). A hospital-based study reported a high prevalence of DPN (69.2%) among type 2 diabetic patients (15). In Jeddah City, prevalence of DPN, based on a combination of neurological symptoms and reduced vibration perception was reported to be 19.9% (6).

A study on diabetic patients in US and Europe reported that prevalence of DPN ranged from 6% to 51%, based on the population studied (16). In India, prevalence of DPN was reported to be 47% in the Indian study, and it was associated with a longer duration of diabetes (17).

These wide variations in prevalence rates of DPN reported by different studies may be explained by that assessment of DPN prevalence depends on several factors, such as type of diabetes, study population, criteria for case definition, glycemic control and duration of diabetes. Prevalence of DPN can be reduced by provision of high health care and strictly controlling blood sugar (18).

Wang et al. (6) reported that prevalence of DPN among diabetic patients was associated with their glycemic control, duration of diabetes, and abdominal obesity. Aljohani et al. (15) noted that the risk factors for DPN include high HbA1c, patient's age, and duration of diabetes. Similarly, Akbar et al. reported that factors including poor glycemic control, longer duration of diabetes, smoking, and older age were reported to be risk factors for DPN among Saudi patients with T2DM (19).

In conclusion, this study revealed that type 2 diabetic patients in Muhayil city, Saudi Arabia, have poor awareness about DPN and its risk factors. Since diabetic patients are at high risk of developing such complications, it is necessary to conduct intensive health education about diabetes and its complications, that should start at the time of diagnosis to minimize the risk factors of DPN among these patients, and to maintain regular clinical assessment to detect DPN. Moreover, family physicians should be aware of DPN symptoms and complications for diabetic patients at the follow up clinics, and do annual screening for DPN. Diabetic patients should be trained to do proper foot self-care, and blood glucose control, to prevent and delay DPN as much as possible. Diabetic patients should be motivated to maintain healthy weight, do regular and annual investigations and screening, and to manage any associated chronic diseases.

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