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Diabetic foot examination by family physicians as reported by diabetic patients: A cross-sectional study

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Abstract
Background: Diabetes prevalence is increasing globally and Saudi Arabia is not an exception. As a result, diabetic foot complications are increasing. Such complications can be prevented by regular foot examination. We conducted this study aiming to assess the rate of physicians performing foot examination and education that is reported by diabetic patients and to explore the clinical and demographic variables that may affect physician performance in diabetic foot examination and education.
Methods: A cross-sectional study was conducted among diabetic patients at AL-Wezarat diabetic clinic, PSMMC, Riyadh, Saudi Arabia. Data was collected through a questionnaire that was previously used in a similar study, the questionnaire was translated into Arabic validated and distributed randomly to the sample population.
Results: A total of 248 patients' medical records were analyzed, more than half (56.10%) were females, and 15.29% were smokers. Diabetic foot complications were prevalent among 76.23% of the participants, and the prevalence of foot ulcers was 7.26%. The majority of the respondents reported that their physicians examined their feet during the last year at 84.21%, and more than half (54.33%) said that the physicians examine their feet every visit. Inspection only was the most used method by 87.80%. The prevalence of diabetic foot was significantly higher among females at 61.6% compared to 38.4% among males. Similarly, the correlation was statistically significant with educational level, employment status and smoking.
Conclusion: According to the current study findings, diabetic foot examination by family physicians is considered high, as reported by diabetic patients; however, the examination was mostly by inspection rather than specific tool examination. The reasons for such findings should be addressed in future studies in order to learn the causes and put solutions in place by health care authorities in order to help prevent diabetic foot complications.

Keywords: Diabetic, physicians, patients, patients, cross-sectional

Introduction
The prevalence of diabetes mellitus is increasing globally, and Saudi Arabia is not an exception. Saudi Arabia is considered one of the top ten countries highest prevalence with a diabetes prevalence of 23.9% [1]. Diabetic complications occur frequently, approximately affecting all body parts in the long run. Nevertheless, foot complications in diabetics affect 6% and between 0.03% and 1.5% need amputation which usually starts with an ulcer, that can be prevented by simple, easy, and quick examination of the foot [2]. Foot complications in diabetes can be caused by peripheral neuropathy and ischemia from vascular disease [3]. Such foot complications could end up with devastating and unpleasant results to the patient which can affect his life and functional status.
According to the recommendation by American Diabetes Association (ADA), foot examination must be done at least annually or more among patients with high risk. High-risk patients are those who are prone to ulcers, having an old one, neuropathy or vascular disease [4]. However, every patient with diabetes has to be inspected every visit. As per the CDC data 2015, one-third of the diabetic patients were not examined by their health care provider every year [4]. Moreover, patient self-care education is crucial and it has to be provided by family physicians [5]. All these measures may play a role in prevention, which is the main purpose of primary care. In addition, increasing the compliance of foot examinations will lead to better outcomes. Data in regards to the rates of foot examination by primary care physicians for diabetic patients and its related factors are scarce in Saudi Arabia. We conducted this study in a trial to fill this literature gap.

Methods

This was a cross-sectional study conducted at AL-Wezarat diabetic clinic, Prince Sultan Military Medical City (PSMMC), Riyadh, Saudi Arabia. The study population was all diabetic patients attending the previously mentioned clinic without any restriction on gender, age, diabetes duration, or treatment. While the exclusion criteria were diabetic patients who have a history of developing foot complications or had foot amputation.

The data collection tool for the current study was a questionnaire that have been taken from a similar previous study, then it was translated into Arabic language. After translation, the questionnaire was then validated through a pilot study that was done on 20 diabetic patients who answered it easily within few minutes without facing any problems. The questionnaire was self-administered then was randomly distributed to the diabetic patient in the waiting area. The questionnaire included socio-demographic data (age, gender, education level, smoking, and income), diabetic foot complications if any, how frequently doctors examined patients' feet in the past 12 months, how regularly do patients examine their feet, and whether they received information about foot care. In addition, another sheet including data relevant to patient clinical variables (HA1C, hypertension, dyslipidemia, retinopathy, etc.) was included and was filled by the investigators after reviewing the patients' files.

The study was conducted after taking ethical approval from the institutional review board (IRB) at PSMMC. The aims and objectives of the study were explained to the patients and they were informed that participation is completely voluntary, and data would be kept confidential and anonymous, and will be used for research purposes only.

The Sample size was calculated using qualitative one proportion equation Zα/22 *p*(1-p)/ E2. The prevalence of diabetic patients who have been examined in previous studies is p=21% [11] hence the sample size is 246 diabetic patients, adding a non-respondent rate10%.

Statistical analysis

Data were analyzed by using Statistical Package for Social Studies (SPSS 22; IBM Corp., New York, NY, USA). Continuous variables were expressed as mean ± standard deviation and categorical variables were expressed as percentages. The t-test was used for continuous variables. Chi-square test and Fisher exact test were used for categorical variables. A p-value <0.05 was considered statistically significant.

Table 1: Demographic characteristics of the study sample

		Number	%
Gender	male	108	43.90
	female	138	56.10
Age (Mean, SD)		58.36	12.48
Educational Level	illiterate	90	36.44
	read and write	16	6.48
	primary	23	9.31
	preparatory	16	6.48
	secondary	37	14.98
	college	59	23.89
	high studies	3	1.21
	other	3	1.21
If other please specify	diploma	3	1.21
Currently employed	yes	113	46.50
	no	130	53.50
If yes	governmental sector	50	44.25
	private sector	20	17.70
	business	43	38.05
Monthly income family	less than 5000	108	44.26
	less than 5000-25000	112	45.90
	more than 25000	24	9.84
Residence	Middle	221	89.47
	Eastern	1	0.40
	Northern	3	1.21
	Southern	18	7.29
	Western	4	1.62

Table 2: Foot care and examination

		Number	%
Are you smoker	smoker	37	15.29
	Ex-smoker	1	0.41
	Shisha	6	2.48
	non-smoker	198	81.82
Having diabetic foot complications	yes	186	76.23
	no	58	23.77
If yes which complications	Wound	21	8.47
	Fungal	54	21.77
	Ulcer	18	7.26
	others	114	45.97

Did you get information	yes	201	86.27
	no	32	13.70
If yes which	brochures	20	8.06
	written explanation	6	2.42
	verbal explanation	192	77.42
	others	13	5.24
Did you benefit form given information	yes	196	79.67
	no	50	20.33
Do you examine your foot	yes	240	97.17
	no	7	2.83
If yes when	daily	163	67.92
	weekly	63	26.25
	monthly	10	4.17
	other	4	1.67
Did your physician examine your foot last year	yes	208	84.21
	no	39	15.79
If yes at what time	every visit	113	54.33
	annually	78	37.50
	other	17	8.17
Method of examination	looking only	180	87.80
	using special tools	25	12.20

Table 3: Diabetic complication and HbA1c control

		Number	%
HbA1c control	Controlled	83	33.60
	Uncontrolled	164	66.40
Retinopathy	yes	90	36.59
	no	156	63.41
HTN	yes	138	56.33
	no	107	43.67
Heart disease	yes	35	14.29
	no	210	85.71
Dyslipidemia	Controlled	76	31.28
	Uncontrolled	167	68.72
GFR	high	179	77.16
	low	53	22.84

Table 4: Demographic characteristics of the patients by Diabetic foot

		Diabetic foot		Non-Diabetic foot		P value
		Number	%	Number	%	
Gender	male	71	38.4	34	59.6	0.005*
	female	114	61.6	23	40.4	
Age (Mean, SD)		58.62	13.03	57.07	10.26	0.408
Educational level	Illiterate	80	43.2	8	13.8	<0.001*
	Less than secondary	31	16.8	24	41.4	
	Secondary	21	11.4	15	25.9	
	University and above	53	28.6	11	19.0	
Currently employed	yes	96	53.0	15	25.9	<0.001*
	no	85	47.0	43	74.1	
Monthly income family	less than 5000	89	48.9	18	31.0	<0.001*
	less than 5000-25000	71	39.0	39	67.2	
	more than 25000	22	12.1	1	1.7	
Residence	Middle	161	87.0	56	96.6	0.003*
	Eastern	1	.5	0	0	
	Northern	3	1.6	0	0	
	Southern	16	8.6	2	3.4	
	Western	4	2.2	0	0	

*Significant p value

Table 5: Foot care and examination by Diabetic foot

		Diabetic foot		Non-Diabetic foot		P value
		Number	%	Number	%	
Are you smoker	smoker	35	19.1	2	3.6	0.034*
	Passive smoker	1	.5			
	Shisha	5	2.7	1	1.8	
	non-smoker	142	77.6	53	94.6	

Did you get information	yes	164	94.8	35	60.3	<0.001*
	no	9	5.2	23	39.7	
Brochures	No	167	89.8	57	98.3	0.040*
	Yes	19	10.2	1	1.7	
written explanation	No	181	97.3	57	98.3	0.562
	Yes	5	2.7	1	1.7	
verbal explanation	No	30	16.1	24	41.4	<0.001*
	Yes	156	83.9	34	58.6	
Others	No	173	93.0	58	100.0	0.026*
	Yes	13	7.0			
Did you benefit form given information	yes	160	86.0	35	61.4	<0.001*
	no	26	14.0	22	38.6	
Do you examine your foot	yes	183	98.4	54	93.1	0.057
	no	3	1.6	4	6.9	
If yes when	daily	123	67.2	39	72.2	0.292
	weekly	48	26.2	15	27.8	
	monthly	8	4.4			
	other	4	2.2			
Did your physician examine your foot last year	yes	174	93.5	31	53.4	<0.001*
	no	12	6.5	27	46.6	
If yes at what time	every visit	100	57.5	12	38.7	<0.001*
	annually	65	37.4	11	35.5	
	other	9	5.2	8	25.8	
Method of examination	looking only	152	89.4	25	78.1	0.075
	using special tools	18	10.6	7	21.9	

*Significant p value

Table 6: Diabetic complication and HbA1c control by Diabetic foot

		Diabetic foot		Non-Diabetic foot		P value
		Number	%	Number	%	
HbA1c control	Controlled	62	33.5	17	29.3	0.551
	Uncontrolled	123	66.5	41	70.7	
Retinopathy	yes	72	39.1	16	27.6	0.111
	no	112	60.9	42	72.4	
HTN	yes	101	55.2	33	56.9	0.820
	no	82	44.8	25	43.1	
Heart disease	yes	30	16.4	4	6.9	0.700
	no	153	83.6	54	93.1	
Dyslipidemia	Controlled	55	30.2	18	31.6	0.846
	Uncontrolled	127	69.8	39	68.4	
GFR	high	134	75.7	41	80.4	0.485
	low	43	24.3	10	19.6	

Results

The total number of diabetic medical files included in the current study was 280, though data was incomplete for 32 patients who were excluded from the analysis, therefore, the data of only 246 patients was analyzed. The socio-demographic characteristics of those patients are shown in table (1). The mean (±SD) age of the participants was 58.36(±12.48). More than half (56.10%) of them were females, and the highest percentage were illiterate at 36.44%. A percentage of 53.50% were not employed at the study time and 45.90% had a monthly income of 5000-25000 SAR per month. Participants were mostly from the middle region at 89.47%.

Smoking was reported by 18.7% of the participants while the majority were nonsmokers at 81.82%. Diabetic foot complications were prevalent among 76.23% of the participants, and the prevalence of foot ulcers was 7.26%. The majority (86.57%) of the participants got information about diabetic foot complications, and their information source was mainly through the verbal explanation. More than 79% reported that they benefit from the given information, while the vast majority (97.17%) reported examining their foot mostly (67.92%) on daily bases. The majority of the respondents reported that their physicians examined their feet during the last year at 84.21%, and more than half (54.33%) said that the physicians examine their feet every visit. However, when looking at the examination method we found that inspection only was the most used method by 87.80%. Data is shown in table (2), and figure (2), and the distribution of the type of diabetic foot is shown in figure (1).

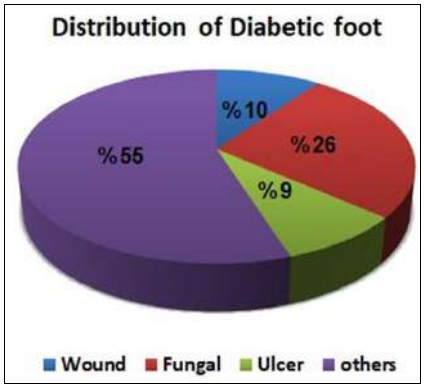

Fig 1: Distribution of Diabetic foot

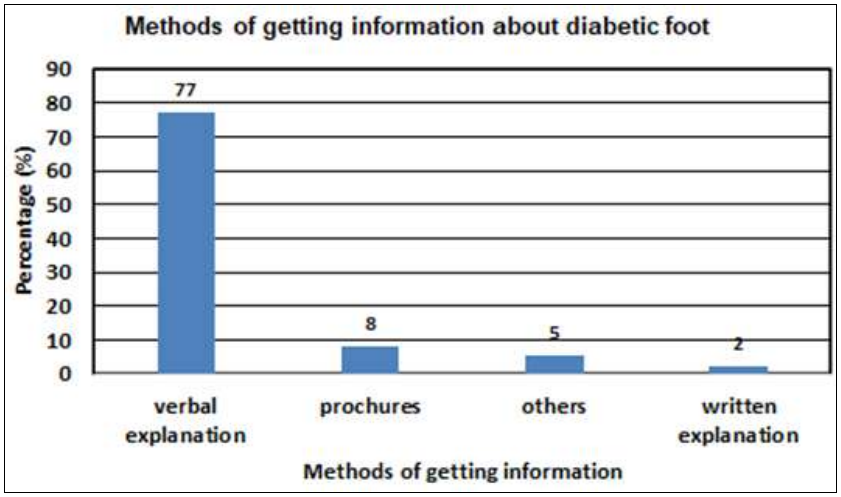

Fig 2: Methods of getting information about diabetic foot

The prevalence of other diabetes complications and HbA1c control is shown in table (3). Blood sugar level was uncontrolled in two-thirds (66.40%) of the participants as indicated by HbA1c level. diabetic retinopathy was prevalent in 36.59%, and heart diseases in 14.29%. More than half (56.33%) of the participants were hypertensive while 68.72% have uncontrolled dyslipidemia.

The correlation between the diabetic foot and patient characteristics is shown in table (4). The prevalence of diabetic foot was significantly higher among females at 61.6% compared to 38.4% among males, with a P-value of 0.005. Similarly, the correlation was statistically significant ($P< 0.05$) with educational level and employment status, being higher among the highly educated and employed ones at 28.6%, and 53%, respectively. The lowest income group (<5000 SAR) showed the highest rate of diabetic foot at 48.9%, compared to 12.1% among the highest income one (25000 SAR), with a p-value of <0.001. On the other hand, there was no statistically significant (P 0.408) association between age and diabetic foot.

The results of the current study revealed a significant (P 0.034) association between smoking and diabetic foot, where it was significantly higher among diabetic foot at 19.1% vs 3.6%, and similar results for shisha smoking at 27% vs. 1.8%, respectively. Significantly higher percentages of diabetic foot patients reported receiving information about foot care compared to those without diabetic foot at 94.8% vs. 60.3% respectively. A significantly lower percentage of diabetic foot participants reported receiving foot care information through brochures at 89.8% compared to 98.3% in the non-diabetic foot group, with a p- value of 0.04. In contrast, a significantly higher percentage of diabetic foot patients reported receiving verbal explanation compared to the other group at 83.95 vs. 58.6%, respectively. A significantly higher percentage of diabetic foot patients reported benefiting from the given information. When participants were asked if they examine their foot, the vast majority of the diabetic foot and non-diabetic foot reported yes at 98.4% and 93.1%, respectively, with no significant difference between the two groups (P 0.057). In contrast, a significantly ($P< 0.001$) higher percentage of diabetic foot patients reported that their physicians examined their foot during the last year at 93.5% compared to 53.4% in the non-diabetic foot group, and this was mostly every visit at 57.5% vs. 38.7%, respectively. The foot examination method did not differ significantly between the two groups and it was mostly inspection only. Data is shown in table (5).

As shown in table (6), the results of the current study showed no significant association between the diabetic foot and any of the following: HbA1c level, diabetic retinopathy, hypertension, heart disease, dyslipidemia, or GFR, where all the P values were >0.05.

Discussion

We set out this cross-sectional study among diabetic patients at the diabetic clinics in PHC centers in Riyadh, Saudi Arabia mainly to assess the rate and methods of foot examination by family physicians as reported by the diabetic patient. The results revealed that, overall, the diabetic foot complications were reported to be prevalent among the participated patients, most of them had their feet examined during the last year, mostly every visit, but the method of examination was mainly by inspection.

Regular foot examinations for diabetic patients are critical for early detecting complications. It was previously reported that there was a 47.4 percent decrease in amputation rates following the implementation of a diabetic foot screening and treatment program [1]. Screening for neuropathy in diabetic patients could aid in identifying those who are at risk for developing diabetic ulcers [2], as peripheral neuropathy is the most common risk to the development of such a consequence [3, 4]. Currently, there is evidence that diabetic peripheral neuropathy develops early during the first year after diabetes [5]. Furthermore, data indicate that 10% of diabetics have diabetic peripheral neuropathy at the time of diabetes diagnosis [6]. Based on these findings, the importance of early, regular and proper examination of diabetic foot is highly recommended. Such examinations should be carried out properly, not only through a simple inspection, as reported by the majority of the patients in the current study, but also by using the recommended examination devices. Inspection alone is not enough in the detection of diabetic foot diseases as palpation of peripheral pulses, and assessment of protective sensation with monofilament are crucially important in discovering the early stages of the disease, as well as other tests such as vibration sensitivity or Achillean reflexes. Furthermore, because many patients with peripheral artery disease (PAD) are asymptomatic, an assessment of the ankle- brachial index (ABI) is recommended [7]. The rate of inspection reported in the current study was far higher compared to a

previous study conducted at 17 health care centers non-randomly distributed in 11 Spanish autonomous communities at 87% vs. 56% respectively [8]. In contrast, the rate of using special tools in the current study was far lower at 12% compared to 39.5% for monofilament examination, 45.8% for distal pulse examination, and 10.1% for ABI.

The overall foot examination rate reported in the current study is considered far higher compared to previous studies in Spanish [8], and Andalusia at 84.21%, 37%, respectively. Besides, in studies assessing various quality indicators and their change over time, the study group of diabetes in PC, red GDPS, reported foot examination rates ranging from % to 64.2% [9, 10]. Moreover, Carral San Laureano *et al.* discovered that 44% of patients had a foot examination in a study assessing the quality of care provided to a diabetes population in both PC and endocrinology clinics [11].

To decrease ulcer incidence, the American *Diabetes Association* (ADA) recommends that patients with diabetes receive general diabetes education in foot care in addition to undergoing careful examination [7]. The majority of the current study participants reported receiving information about diabetic foot care at 86%, a percentage which is higher than what was previously reported in a similar study at 51.2% [8]. Indicating the need to combine both approaches.

The estimated prevalence of diabetic foot ulcers at 9% in the current study is considered higher than the estimated international range (1.8% to 7%) [12, 13]. On the other hand, a higher prevalence was reported in a recently published study from Southwest Ethiopia at 11.6% [14].

For gender differences in the prevalence of diabetic foot complications, the current study results that they are higher in females is in contrast to previous local and international studies findings that showed that they are higher among males [15-17], with no clear justification. For the economic status and residency region, a previous study from Egypt showed that low socioeconomic status and rural residency were significant risk factors for the diabetic foot in type 2 diabetic patients [18]. This study [18], is consistent with our findings that a history of hypertension, hyperlipidemia, or ischemic heart disease did not result in a statistically significant difference between diabetic foot and non-diabetic foot subjects. The scenario with hypertensive patients was explained by the fact that the majority of hypertensive patients in their sample were taking ACE inhibitors, which improved peripheral circulation [19].

According to recently published epidemiological data, the prevalence of any diabetic retinopathy (DR) among diabetic patients was estimated to be 34.6% [20]. A similar prevalence rate was reported in the current study at 36.59%.

In the current study, smoking was statistically significantly higher among diabetic foot patients than the control group (19.1% versus 3.6% respectively). This may contribute to the negative insult of smoking on the cardiovascular system. This is in accordance with a previous study [18]. Also, In this regard, previous studies reported that smoking increases the risk of developing diabetic foot even if being ex-smoker [21, 22].

The current study, like any other, has limitations, including small sample size and data from only one primary health care center in Riyadh, Saudi Arabia. Furthermore, no detailed data on the tools used to examine the patients' feet were collected, which is why only inspection was mostly used rather than detailed and specific tool examination.

Conclusion

According to the current study findings, diabetic foot examination by family physicians is considered high, as reported by diabetic patients; however, the examination was mostly by inspection rather than specific tool examination. The reasons for such findings should be addressed in future studies in order to learn the causes and put solutions in place by health care authorities in order to avoid high rates of diabetic foot complications.

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