

# Foot care among recently diagnosed diabetic patients in Muhayel, Aseer Region, Saudi Arabia

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Received: December 2020; Accepted: January 2021; Published: February 1, 2021.

Citation: Abdullah A. Hassan et al.. Foot care among recently diagnosed diabetic patients in Muhayel, Aseer Region, Saudi Arabia. World Family Medicine. 2021; 19(1): 25-38 DOI:10.5742/MEWFM.2021.93978

## Abstract

**Background:** Amputations and ulcers of foot are the main causes of disability, morbidity, physical and emotional costs among diabetics. Management of their risk factors and early recognition can delay or prevent the beginning of any adverse outcomes.

**Objectives:** To assess the levels of knowledge and practice regarding foot care among recently diagnosed diabetic patients.

**Subjects and Methods:** A cross-sectional study was conducted at primary healthcare centers belonging to the Ministry of Health, Muhayil city, Aseer Region, Kingdom of Saudi Arabia (KSA) among recently diagnosed (i.e., before two years) diabetic patients. A study questionnaire (in a simple Arabic language) was used to collect data related to personal characteristics, present history related to diabetes, fasting blood sugar control (mg/dL), provided medical care, assessment of knowledge about foot self-care and prevention of diabetic foot and assessment of patient's daily practices related to foot self-care.

**Results:** The study included 250 recently diagnosed diabetic patients. Males represented 55.6% of them. Only 14.8% had glycemic control, based on HbA1c level <7%. Generally, 66% of patients had poor knowledge regarding diabetic foot, whereas only 13.6% of them had good knowledge. Good foot care practice was observed among 52% of patients. Young patients (20-30 years old) were more likely to have good foot care practice than those aged over 60 years,  $p=0.026$ . Patients with heart

diseases were significantly less likely to have good foot care practice compared to those without cardiac diseases,  $p=0.039$ . Patients with HbA1c<7% were significantly more likely to express good foot care practice than those with HbA1c  $\geq 7\%$ ,  $p=0.006$ . There was a significant association between patients' knowledge about foot care and their practice,  $p<0.001$ . Regarding provided foot-related health care, 90.8% of patients reported undergoing feet examination by their physicians, 63.2% reported that physicians explained to them the importance of foot care and how to perform it (60.0%). Less than half of patients (45.2%) received health educational brochures about foot care

**Conclusion:** Most recently diagnosed diabetic patients in Muhayil City, Aseer Region, KSA have inadequate knowledge and poor practices regarding foot care. Intensive health education regarding diabetic foot care is highly recommended.

**Key words:** Diabetes mellitus, diabetic foot, foot care, knowledge, practice, Saudi Arabia.

## Introduction

Diabetic foot ulceration (DFU) is one of the major common complications related to diabetes. Approximately 85% of amputations associated with diabetes are preceded by ulcerations. DFU affects about 6% of patients of diabetes and it involves ulceration, infection or destruction of foot tissues. This complication impairs the quality of life of patients and can affect their life and social participation. Almost 0.03% to 1.5% of diabetic patients undergo amputations. However, most of their foot ulcers are preventable through effective screening and sufficient foot care(1).

According to Edmonds et al., (1) foot ulcerations in diabetic patients are common and costly, and make up approximately half of hospital amputation admissions. Although there is not enough evidence that shows whether foot care education plays a key role in reducing ulceration risks, a detailed understanding of ulceration etiopathogenesis is crucial in reducing foot lesion incidence and ultimately amputations.

The International Diabetes Federation reported that between 9 to 26 million diabetic people develop foot ulcers each year (2). Diabetic foot is a foot that is affected by ulceration associated with peripheral arterial disease and neuropathy of the lower limb of diabetic patients.

Hanson (3) pointed out that risk factors in diabetic foot development include cigarette smoking, diabetic neuropathy, previous ulceration of foot or amputation, peripheral vascular disease, ischemia of both large and small blood vessels, and diabetic nephropathy. The beginning of foot ulcer may cause swelling, pain, numbness, gangrene forms and deformity. Standard treatment of diabetic foot involves wound debridement, infection management, revascularization procedures and off-loading of ulcer.

Feet are the most common body parts that receive the least importance in daily care. Amputations and ulcers of foot are the main cause of disability, morbidity, physical and emotional costs of diabetic people. Diabetics are highly prone to serious foot complications which are a leading cause of their hospitalization. About 15% of diabetics are likely to develop serious foot complications. Good practice and knowledge concerning diabetic foot care will reduce and prevent the risks of complications of diabetic foot and ultimately amputation. Knowledge deficiency of foot care and poor foot care practices are among the major risk factors for foot complications (1).

Most diabetic patients admitted for foot complications are known to have inadequate knowledge and poor practice for diabetic foot care. Shearman (2) recommended that health education about strategies of foot care should be given emphasis and must be able to empower patients of diabetes. Diabetic foot complications are the leading cause of mortality, particularly in developing countries (4).

## Aim of study

To assess the levels of knowledge and practice regarding foot care among recently diagnosed diabetic patients in Muhayel City, Aseer Region, KSA.

## Methodology

This study was conducted during the period between January and June 2020. Following a cross-sectional study design, a total of 250 diabetic patients, registered at 26 primary healthcare centers belonging to the Saudi Ministry of Health, Muhayil City, Aseer Region, were included. The inclusion criteria were: being Saudi, adults, recently diagnosed (since two years or less) type 2 diabetics, and aged 20 years or more.

In each selected primary healthcare center, recently diagnosed diabetic patients were recruited consecutively. The number of patients chosen from each center was proportional to the total number of new cases registered in the center. The patients were interviewed and examined while they were waiting for their physician's appointment at the "Chronic Diseases" clinics.

For data collection, the researchers used the study questionnaire of Al-Asmary et al (5).

It includes the following parts (in a simple Arabic language):

A- Personal characteristics: age, sex, occupation, educational and smoking status.

B- Present history related to diabetes: Duration of diabetes, associated comorbidity (e.g., obesity, hypertension, dyslipidemia), and foot-related symptoms.

C- Fasting blood sugar control (mg/dL): Fasting blood sugar control was classified as follows:

- Good (<126 mg/dL)
- Acceptable (126-180 mg/dL)
- Bad (>180 mg/dL)

D- Provided medical care: provision of health education, foot examination, referral to a podiatric clinic.

E- Assessment of knowledge about foot self-care and prevention of diabetic foot: This part included 13 questions, which covered the necessary knowledge related to foot self-care. Patients' responses were given a score of (1) if correct, or a score of (0) if wrong or unknown. Then the total score and percentage were calculated for the knowledge part. Percentage scores of 75% or above were considered "good" knowledge level, 50-74.9% were considered as acceptable, while percentage scores <50% were considered as "bad" level of knowledge.

F- Assessment of patient's daily practices related to foot self-care: This part included nine practice statements related to foot self-care. Patients' responses were scored as follows: (always=4, often=3, sometimes= 2, rarely=1 or never=0). Then the total score and percentage were calculated for the practice part. Percentage scores below 50% were considered as "poor" practice, whereas scores >50% were considered as "good" practice.

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. Pearson's chi-square test was utilized to test for the association between qualitative variables, Fischer Exact test was applied instead of Chi-square test in case of small frequencies, student t-test to compare mean of a quantitative continuous variable between two different groups and one-way analysis of variance (ANOVA) test was used to compare means between more than two groups. Statistical significance was determined at p-values less than 0.05.

All the necessary official and ethical approval 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-King Khaled University (ECM#2020-141)-(HAPO-06-B-001) dated 02/01/2020.

## Results

Table 1 shows that 55.6% of participants were males. The age of 34.4% exceeded 60 years, whereas that of 29.2% ranged between 51 and 60 years. More than half of participants (56%) were not employed, while only 17.6% were employed. More than one-third (36.4%) were illiterate, whereas 6.4% were university graduates and above. Most participants (82.8%) were married. Prevalence of smoking among the participants was 12.4%; associated diabetes-related complications were heart disease (4%), nephropathy (4%) and retinopathy (11.2%). Associated chronic diseases were hypertension (46%), dyslipidemia (30%) and obesity (19.6%). Diabetes control (as indicated by fasting blood sugar levels) was good among 12% of participants, acceptable among 51.2% and bad among 36.8%. Glycemic control (<7%) was fulfilled by 14.8% of patients.

Table 2 shows that among recently diagnosed diabetics, numbness, hotness and tingling, were reported by 24%, 20.8%, and 15.6%, respectively. Pain or cramps during walking were reported by 26.4% and 17.6%, respectively. Foot cracks were reported by 14.4% of patients, 4% had wounds, 2.4% had foot ulcers, while 1.2% underwent amputation.

Table 3 shows that the highest correctly known cause for diabetic foot was uncontrolled blood sugar (56.4%), whereas the lowest known was delayed diagnosis of diabetes mellitus (24.4%). The highest known diabetic foot complication was foot cracks and ulcers (48%). Most participants (74.4%) knew that diabetic foot is very dangerous. More than half of patients (58%) could recognize that they should visit a physician in case of finding a foot wound. Regarding what should be checked daily, diminished sensation, change in foot color and appearance of wounds/cracks were mentioned by 54.4%, 38.8% and 36.4%, respectively. Only 21.2% of patients

knew that trimming toe-nails decreases incidence of diabetic foot.

Figure 1 shows that knowledge of 66% of patients regarding diabetic foot was bad, whereas only 13.6% had good knowledge.

Table 4 shows that patients' knowledge levels about diabetic foot did not differ significantly according to their personal characteristics.

Table 5 shows that patients' knowledge levels about diabetic foot did not differ significantly according to their disease characteristics.

Table (6) shows that 48.4% of patients reported that they examine their feet some days, whereas only 5.2% reported that they always examine their feet daily. Approximately half of patients (50.4%) reported washing their feet daily. More than one-third of patients (38.4%) reported drying their feet sometimes, especially between their toes immediately after washing, whereas only 8.4% of them always did that. More than one third of patients (36.4%) rarely apply a moisturizing agent to their skin feet, while only 6.4% always did that. Trimming of toe-nails, carefully and regularly was done sometimes by 46.4% and always by 13.2% of patients. Avoiding walking with bare-feet was done sometimes by 47.2% of patients and always by 12.8%. Checking water temperature by elbow before washing feet was always done by 6.4% of patients and rarely by 48%. Making sure that the shoes do not contain any harmful objects was rarely performed by 42.8% of patients and was always done by 10%. The choice of the proper type of shoes was always or often done by 46.8% of patients.

Figure 2 shows that good foot care practice was performed by 52% of participant diabetic patients.

Table 7 shows that diabetic patients' practices regarding foot care differed significantly according to their age groups ( $p=0.026$ ), with those aged 20-30 years having the highest good level of practice and those aged over 60 years having the lowest good level of practice (71.4% and 39.5%, respectively). However, patients' practices regarding foot care did not differ significantly according to other personal characteristics.

Table 8 shows that patients with heart diseases were significantly less likely to have good foot care practices compared to those without heart diseases (53.3% versus 20%, respectively,  $p=0.039$ ). Patients with HbA1c <7% were significantly more likely to express good foot care practices than those whose HbA1c  $\geq 7\%$  (73% versus 48.4%, respectively,  $p=0.006$ ). However, other studied disease characteristics did not differ significantly regarding foot care practices according to their disease characteristics.

Table 9 shows a statistically significant association between levels of knowledge about foot care and its practice ( $p<0.001$ ). Patients with good knowledge level

had the highest good level of practice, while those with bad knowledge had the lowest practice level (76.5% and 41.8%, respectively).

Table 10 shows that almost all diabetic patients were examined by their physicians for their peripheral pulses (99.6%), intact peripheral nerves (99.6%) and foot cleanliness (98.8%). However, less than half of them were examined for feet dryness (40.4%), shoes suitability (37.2%), foot ulcer/wounds (36%) or fungal infection between toes (26.8%).

Table 11 shows that, regarding provided foot-related healthcare to recently diagnosed diabetic patients among diabetic patients, the majority (90.8%) reported their feet examination being examined by physicians. Almost two-thirds (63.2%) reported that physicians explained to them the importance of foot care and how to perform it (60.0%). Less than half of them (45.2%) received health educational brochures about foot care and only 10.4% were referred for diabetic foot care in the hospital.

## Discussion

In the present study, the highest known cause for diabetic foot among participants was uncontrolled blood sugar, whereas the lowest known was delayed diagnosis of diabetes mellitus. Also, the highest known complication of diabetic foot was foot cracks and ulcers and most participants knew that diabetic foot is very dangerous. Regarding the signs, diminished sensation, change in foot color and appearance of wounds/cracks were mentioned by about one-third to half of patients. However, only one-fifth of patients knew that trimming toe-nails decreases rate of diabetic foot. Overall, 66% of the recently diagnosed diabetics had bad knowledge regarding diabetic foot and only 13.6% had good knowledge.

Similar findings were observed in a recent study carried out in Iran, where 84.8% of patients had poor knowledge regarding diabetic foot (6). Also, deficient knowledge regarding foot care was observed in other studies carried out in Iraq (mean score:  $6.1 \pm 2.6$ , out of 11),(7) Nigeria (30.1%),(8) Nepal (12.3%),(9) Iran (23.3%),(10) Thailand (mean score:  $8.63 \pm 2.5$  out of 15),(11) South Africa (32.4%),(12) and Malaysia (42%) (13). On the other hand, some other studies reported acceptable levels of knowledge regarding diabetic foot care(14-20).

The differences among various studies regarding reported diabetic patients' knowledge levels about foot care could be attributed to using different tools in assessing levels of knowledge or applying different training programs on diabetic foot care by healthcare professionals in various settings (16) and also the educational level of the studied subjects.

In the present study, participants' levels of knowledge did not differ significantly according to their personal or diabetes-related characteristics.

In Iraq, Saber and Daoud (7) found that diabetic patients who were obese, smoker, or with improper glycemic

control had higher knowledge level about diabetic foot. In India (17) as well as another Saudi study(18), patients' educational level and duration of diabetes were significant predictors for patients' knowledge about diabetic foot.

In the present study, only 5.2% of patients reported always doing feet examination and approximately half of them reported daily washing of their feet. About one-third of patients reported drying of feet sometimes, especially between toes immediately after washing, whereas a minority of them did this always. More than one-third of patients rarely applied a moisturizing agent to the skin of their feet and sometimes trimmed their toe-nails carefully and regularly by 46.4% and always by 13.2% of them. Checking water's temperature by their elbow before washing their feet was rarely done by half of patients. Making sure that the shoes do not contain any harmful objects was done always by only 10% of patients and choice of the proper type of shoes was always or often done by half of them.

Among all these practices, finding that only half of patients reported washing of feet daily is lower than expected since people in Saudi Arabia are Muslims and have to wash their feet 5 times daily for their daily prayers. May be they considered washing feet as a separate issue from washing for praying. Also, in the present study and in accordance with another Iraqi study(7) one of the most neglected practices was drying their feet, particularly between toes after washing them.

Overall, in the present study, good foot care practice was observed among 52% of participant diabetics. Close to that, in Iran(21) 50.4% of diabetic patients expressed good performance regarding diabetic foot care. Also in accordance with the same study and others conducted in Iraq,(7) South Africa,(12) Bangladesh,(22) Tanzania,(23) and Sri Lanka,(24) there was a reported significant association between good knowledge of foot care and good level of practicing it. In a study carried out in Malaysia, 61.8% of diabetic patients had poor diabetic foot care practice (13). In Iraq,(7) moderate practice score was observed among 40% of type 2 diabetic adult patients. In Thailand(11) 60% of the patients expressed poor diabetic foot care practice.

It would be difficult to compare results of the present study with those of other studies as a result of variation between them regarding the nature of the study populations and the applied measures to assess practice.

In the current survey, younger patients, those without heart diseases and those with glycemic control ( $HbA1c < 7\%$ ) were more likely to express good foot care practices.

In a recent Iranian study(6) history of hospital admission due to diabetic foot was a determinant of foot care good practice. In Thailand(11) gender, family history of diabetes, socio-economic status and marital status were significantly associated with levels of diabetic foot care practice among patients.

Table 1: Characteristics of recently diagnosed type-2 diabetic participants (n=250)

Characteristics	Values
<b>Sex</b>	
• Male	139 (55.6%)
• Female	111 (44.4%)
<b>Age (years)</b>	
• 20-30	7 (2.8%)
• 31-40	20 (8.0%)
• 41-50	64 (25.6%)
• 51-60	73 (29.2%)
• >60	86 (34.4%)
<b>Occupation</b>	
• Employee	44 (17.6%)
• Not employee	140 (56.0%)
• Retired	66 (26.4%)
<b>Education</b>	
• Illiterate	91 (36.4%)
• Able to read and write	61 (24.4%)
• Primary school	26 (10.4%)
• Intermediate school	25 (10.0%)
• Secondary school	31 (12.4%)
• University	16 (6.4%)
<b>Marital status</b>	
• Single	13 (5.2%)
• Married	207 (82.8%)
• Divorced	5 (2.0%)
• Widow	25 (10.0%)
<b>Smoking status</b>	
• Smoker	31 (12.4%)
• Non-smoker	219 (87.6%)
<b>Duration of diabetes (Mean±SD)</b>	14.3±7.3 months
<b>Diabetes-related complications</b>	
• Heart disease	10 (4.0%)
• Renal disease (Nephropathy)	10 (4.0%)
• Eye disease (retinopathy)	28 (11.2%)
<b>Associated comorbidity</b>	
• Hypertension	115 (46.0%)
• Dyslipidemia	75 (30.0%)
• Obesity	49 (19.6%)
<b>Blood sugar control</b>	
• Good	30 (12.0%)
• Acceptable	128 (51.2%)
• Bad	92 (36.8%)
<b>Glycemic control (&lt;7%)</b>	37 (14.8%)

**Table 2: Clinical findings among recently diagnosed diabetic patients**

Clinical findings	No. (%)
<b>Symptoms</b>	
• Numbness	60 (24.0%)
• Hotness	52 (20.8%)
• Tingling	39 (15.6%)
• Pain during walking	66 (26.4%)
• Cramps during walking	44 (17.6%)
<b>Signs/complications</b>	
• Cracks	36 (14.4%)
• Wound	10 (4.0%)
• Ulcers	6 (2.4%)
• Amputation	3 (1.2%)

**Table 3: Participants' correct responses regarding knowledge statements about diabetic foot**

Knowledge statements	No.	%
<b>Causes of diabetic foot</b>		
- Uncontrolled blood sugar (Yes)	14	56.4
- No regular foot check-up (Yes)	100	40.0
- Delayed diagnosis of diabetes mellitus (Yes)	61	24.4
<b>Complications of diabetic foot</b>		
- Hotness of feet and painful sensation (Yes)	116	46.4
- Foot cracks and ulcers (Yes)	120	48.0
- Foot gangrene (Yes)	88	35.2
<b>What is the degree of dangerousness of diabetic foot (very dangerous)</b>	186	74.4
<b>What to do in case of finding a foot wound? (visiting a physician)</b>	145	58.0
<b>What should you check daily in your feet?</b>		
- Diminished sensation (Yes)	136	54.4
- Change in foot color (Yes)	97	38.8
- Change in foot temperature (Yes)	37	26.8
- Appearance of wounds/cracks (Yes)	91	36.4
<b>To what extent toe-nail trimming decreases rate of diabetic foot? (always)</b>	53	21.2

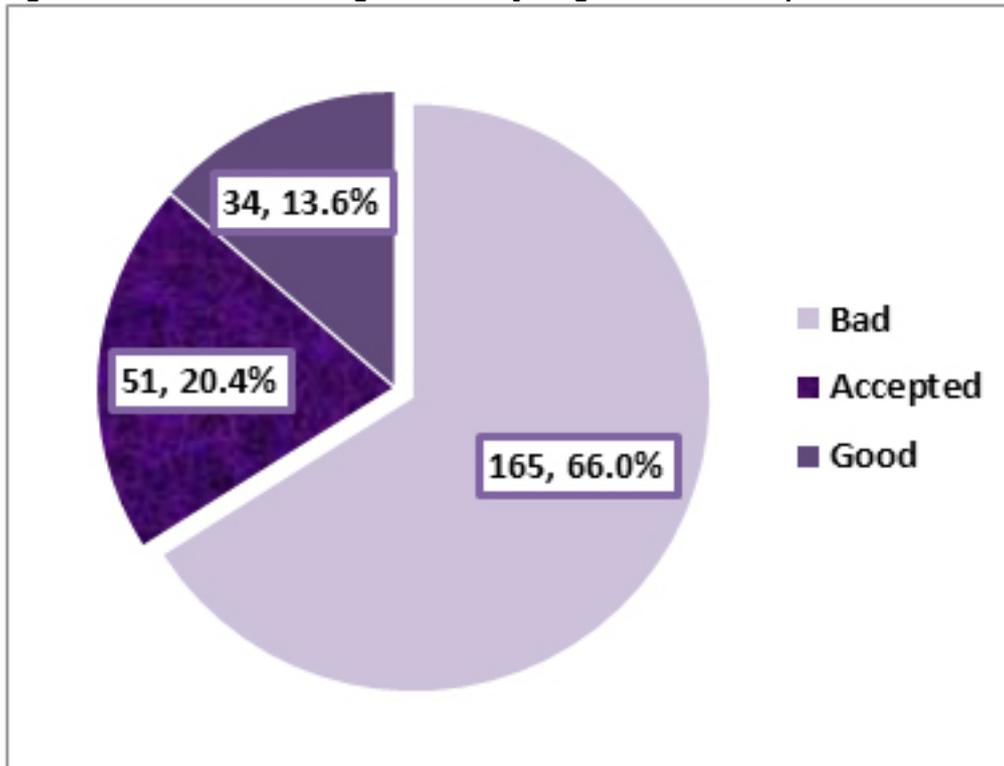
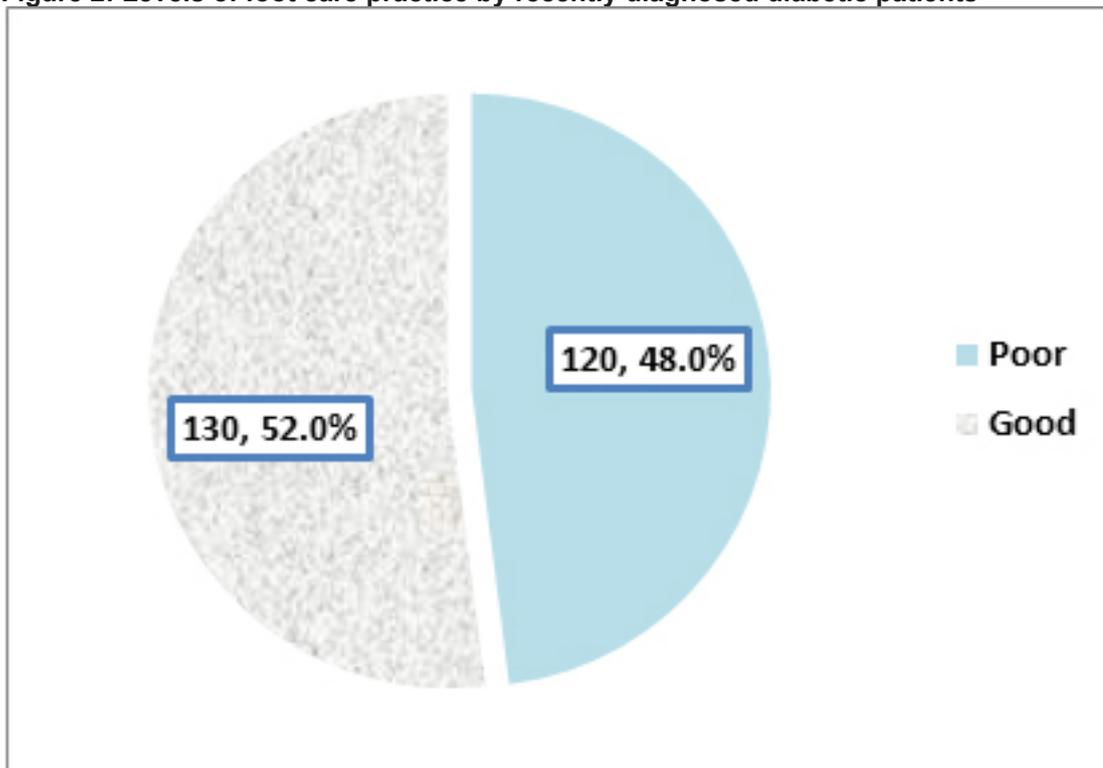
**Figure 1: Levels of knowledge of recently diagnosed diabetic patients about diabetic foot****Figure 2: Levels of foot care practice by recently diagnosed diabetic patients**

Table 4: Diabetic patients' knowledge levels about diabetic according to their personal characteristics

Personal characteristics	Levels of knowledge about diabetic foot			P value
	Bad (n=165)	Acceptable (n=51)	Good (n=34)	
<b>Sex</b> <ul style="list-style-type: none"> <li>• Male (n=139)</li> <li>• Female (n=111)</li> </ul>	92 (66.2%) 73 (65.8%)	23 (16.5%) 28 (25.2%)	24 (17.3%) 10 (9.0%)	0.068
<b>Age (years)</b> <ul style="list-style-type: none"> <li>• 20-30 (n=7)</li> <li>• 31-40 (n=20)</li> <li>• 41-50 (n=64)</li> <li>• 51-60 (n=73)</li> <li>• &gt;60 (n=86)</li> </ul>	5 (71.4%) 16 (80.0%) 36 (56.3%) 53 (72.7%) 55 (64.0%)	2 (28.6%) 2 (10.0%) 13 (20.3%) 15 (20.5%) 19 (22.0%)	0 (0.0%) 2 (10.0%) 15 (23.4%) 5 (6.8%) 12 (14.0%)	0.168
<b>Occupation</b> <ul style="list-style-type: none"> <li>• Employee (n=44)</li> <li>• Not employee (n=140)</li> <li>• Retired (n=66)</li> </ul>	28 (63.6%) 95 (67.9%) 42 (63.6%)	8 (18.2%) 31 (22.1%) 12 (18.2%)	8 (18.2%) 14 (10.0%) 12 (18.2%)	0.452
<b>Education</b> <ul style="list-style-type: none"> <li>• Illiterate (n=91)</li> <li>• Able to read and write (n=61)</li> <li>• Primary school (n=26)</li> <li>• Intermediate school (n=25)</li> <li>• Secondary school (n=31)</li> <li>• University (n=16)</li> </ul>	60 (65.9%) 40 (65.6%) 19 (73.1%) 19 (76.0%) 18 (58.1%) 9 (56.2%)	20 (22.0%) 11 (18.0%) 5 (19.2%) 5 (20.0%) 7 (22.6%) 3 (18.8%)	11 (12.1%) 10 (16.4%) 2 (7.7%) 1 (4.0%) 6 (19.4%) 4 (25.0%)	0.759
<b>Marital status</b> <ul style="list-style-type: none"> <li>• Single (n=13)</li> <li>• Married (n=207)</li> <li>• Divorced (n=5)</li> <li>• Widow (n=25)</li> </ul>	9 (69.2%) 135 (65.2%) 4 (80.0%) 17 (68.0%)	2 (15.4%) 44 (21.3%) 1 (20.0%) 4 (16.0%)	2 (15.4%) 28 (13.5%) 0 (0.0%) 4 (16.0%)	0.960
<b>Smoking status</b> <ul style="list-style-type: none"> <li>• Smoker (n=31)</li> <li>• Non-smoker (n=219)</li> </ul>	21 (67.7%) 144 (65.7%)	7 (22.6%) 44 (20.1%)	3 (9.7%) 31 (14.2%)	0.779

Table 5: Diabetic patients' knowledge levels about diabetic foot according to their disease characteristics

Disease characteristics	Knowledge levels about diabetic foot			P Value
	Bad (n=165)	Acceptable (n=51)	Good (n=34)	
Duration of diabetes (Mean±SD)	14.1±7.5	14.9±6.6	14.2±7.2	0.789
Associated diseases				
-Hypertension				
• Yes (n=115)	75 (65.2%)	25 (21.7%)	15 (13.0%)	0.880
• No (n=135)	90 (66.7%)	26 (19.3%)	19 (14.1%)	
-Dyslipidemia				
• Yes (n=75)	50 (66.7%)	17 (22.7%)	8 (10.7%)	0.620
• No (n=175)	115 (65.7%)	34 (19.4%)	26 (14.9%)	
-Obesity				
• Yes (n=49)	37 (75.5%)	9 (18.4%)	3 (6.1%)	0.177
• No (n=201)	128 (63.7%)	42 (20.9%)	31 (15.4%)	
-Cardiac diseases				
• Yes (n=10)	7 (70.0%)	2 (20.0%)	1 (10.0%)	0.939
• No (n=240)	158 (65.8%)	49 (20.4%)	33 (13.8%)	
-Renal diseases				
• Yes (n=10)	8 (80.0%)	1 (10.0%)	1 (10.0%)	0.619
• No (n=240)	157 (65.4%)	50 (20.8%)	33 (13.8%)	
-Eye diseases				
• Yes (n=28)	18 (64.3%)	4 (14.3%)	6 (21.4%)	0.366
• No (n=222)	147 (66.2%)	47 (21.2%)	28 (12.6%)	
Fasting blood sugar				
• Bad (>180 mg/dL) (n=92)	57 (62.0%)	21 (22.8%)	14 (15.2%)	0.828
• Acceptable (126-180 mg/dL) (n=128)	86 (67.2%)	25 (19.5%)	17 (13.3%)	
• Good (72-126 mg/dL) (n=30)	22 (73.3%)	5 (16.7%)	3 (10.0%)	
Glycemic control				
• HbA1c<7% (n=37)	20 (54.1%)	10 (27.0%)	7 (18.9%)	0.249
• HbA1c ≥7% (n=213)	145 (68.1%)	41 (19.2%)	27 (12.7%)	

Table 6: Frequency of recently diagnosed patients` practice of foot care

	Always	Often	Sometimes	Rarely	Never
Daily examination of feet	13 (5.2%)	59 (23.6%)	121 (48.4%)	49 (19.6%)	8 (3.2%)
Washing feet daily	126 (50.4%)	87 (34.8%)	27 (10.8%)	10 (4.0%)	0 (0.0%)
Drying feet, especially between toes immediately after washing	21 (8.4%)	43 (17.2%)	96 (38.4%)	77 (30.8%)	13 (5.2%)
Regularly applying a moisturizing agent to the foot skin	16 (6.4%)	41 (16.4%)	80 (32.0%)	91 (36.4%)	22 (8.8%)
Trimming toe-nails carefully and regularly	33 (13.2%)	72 (28.8%)	116 (46.4%)	29 (11.6%)	0 (0.0%)
Avoiding walking with bare feet	32 (12.8%)	50 (20.0%)	118 (47.2%)	43 (17.2%)	7 (2.8%)
Checking water's temperature by elbow before washing feet	16 (6.4%)	25 (10.0%)	64 (25.6%)	120 (48.0%)	25 (10.0%)
Making sure that the shoes do not contain any harmful objects	25 (10.0%)	39 (15.6%)	47 (18.8%)	107 (42.8%)	32 (12.8%)
Choice of proper type of shoes	18 (7.2%)	99 (39.6%)	61 (24.4%)	36 (14.4%)	36 (14.4%)

Table 7: Diabetic patients' practice levels about diabetic foot according to their personal characteristics

Personal characteristics	Level of foot care practice		P value
	Poor N=120	Good N=130	
<b>Sex</b> <ul style="list-style-type: none"> <li>• Male (n=139)</li> <li>• Female (n=111)</li> </ul>	66 (47.5%) 54 (48.6%)	73 (52.5%) 57 (51.4%)	0.854
<b>Age (years)</b> <ul style="list-style-type: none"> <li>• 20-30 (n=7)</li> <li>• 31-40 (n=20)</li> <li>• 41-50 (n=64)</li> <li>• 51-60 (n=73)</li> <li>• &gt;60 (n=86)</li> </ul>	2 (28.6%) 11 (55.0%) 23 (35.9%) 32 (43.8%) 52 (60.5%)	4 (71.4%) 9 (45.0%) 41 (64.1%) 41 (56.2%) 34 (39.5%)	0.026*
<b>Occupation</b> <ul style="list-style-type: none"> <li>• Employee (n=44)</li> <li>• Not employee (n=140)</li> <li>• Retired (n=66)</li> </ul>	20 (45.5%) 76 (54.3%) 24 (36.4%)	24 (54.5%) 64 (45.7%) 42 (63.6%)	0.052
<b>Education</b> <ul style="list-style-type: none"> <li>• Illiterate (n=91)</li> <li>• Able to read and write (n=61)</li> <li>• Primary school (n=26)</li> <li>• Intermediate school (n=25)</li> <li>• Secondary school (n=31)</li> <li>• University/+ (n=16)</li> </ul>	48 (52.7%) 31 (50.8%) 10 (38.5%) 13 (52.0%) 12 (38.7%) 6 (37.5%)	43 (47.3%) 30 (49.2%) 16 (61.5%) 12 (48.0%) 19 (61.3%) 10 (62.5%)	0.564
<b>Marital status</b> <ul style="list-style-type: none"> <li>• Single (n=13)</li> <li>• Married (n=207)</li> <li>• Divorced (n=5)</li> <li>• Widow (n=25)</li> </ul>	5 (38.5%) 103 (49.8%) 3 (60.0%) 9 (36.0%)	8 (61.5%) 104 (50.2%) 2 (40.0%) 16 (64.0%)	0.482
<b>Smoking status</b> <ul style="list-style-type: none"> <li>• Smoker (n=31)</li> <li>• Non-smoker (n=219)</li> </ul>	14 (45.2%) 106 (48.4%)	17 (54.8%) 113 (51.6%)	0.735

\* Statistically significant

Table 8: Diabetic patients' practice levels about diabetic foot according to their disease characteristics

Disease characteristics	Level of foot care practice		P Value
	Poor N=120	Good N=130	
Duration of diabetes (Mean±SD)	14.3±7.6	14.3±7.1	0.977
Associated diseases			
- Hypertension			
• Yes (n=115)	58 (50.4%)	57 (49.6%)	0.477
• No (n=135)	62 (45.9%)	73 (54.1%)	
- Dyslipidemia			
• Yes (n=75)	34 (45.3%)	41 (54.7%)	0.581
• No (n=175)	86 (49.1%)	89 (50.9%)	
- Obesity			
• Yes (n=49)	24 (49.0%)	25 (51.0%)	0.878
• No (n=201)	96 (47.8%)	105 (52.2%)	
- Heart diseases			
• Yes (n=10)	8 (80.0%)	2 (20.0%)	0.039*
• No (n=240)	112 (46.7%)	128 (53.3%)	
- Renal diseases			
• Yes (n=10)	5 (50.0%)	5 (50.0%)	0.897
• No (n=240)	115 (47.9%)	125 (52.1%)	
- Eye diseases			
• Yes (n=28)	15 (53.6%)	13 (46.4%)	0.531
• No (n=222)	105 (47.3%)	117 (52.7%)	
Fasting blood sugar			
• Bad (>180 mg/dL) (n=92)	5 (5.4%)	42 (45.7%)	0.307
• Acceptable (126-180 mg/dL) (n=128)	57 (44.5%)	71 (55.5%)	
• Good (72-126 mg/dL) (n=30)	13 (43.3%)	17 (56.7%)	
Glycemic control			
• HbA1c <7% (n=37)	10 (27.0%)	27 (73.0%)	0.006*
• HbA1c ≥7% (n=213)	110 (51.6%)	103 (48.4%)	

\* Statistically significant

Table 9: Association between knowledge regarding foot care and its practice among recently diagnosed diabetic patients

Knowledge of foot care	Level of foot care practice		P value
	Poor N=120	Good N=130	
Bad (n=165)	96 (58.2%)	69 (41.8%)	<0.001*
Acceptable (n=51)	16 (31.4%)	35 (68.6%)	
Good (n=34)	8 (23.5%)	26 (76.5%)	

\* Statistically significant

**Table 10: Frequency of clinical feet examination items of recently diagnosed diabetics by physicians**

Items of foot examination	No. (%)
Cleanliness	247 (98.8%)
Dryness	101 (40.4%)
Shoes suitability	93 (37.2%)
Fungal infection between toes	67 (26.8%)
Ulcers/wounds	90 (36.0%)
Existence of peripheral pulse	249 (99.6%)
Intact peripheral nerves	249 (99.6%)

**Table 11: Provided foot-related healthcare among recently diagnosed diabetic patients**

Foot-related healthcare items	No. (%)
The physicians explain the importance of foot care	158 (63.2%)
The physicians explain how to perform foot care	150 (60.0%)
Receiving health educational brochures about foot care	113 (45.2%)
Feet have been clinically examined by the physicians last year	227 (90.8%)
Referral for diabetic foot care in the hospital	26 (10.4%)

A point of strength in the present survey was that it is the first to explore this important issue in Muhayel City, Aseer Region, KSA. Nevertheless, this study has some limitations that should be declared. First, it followed a cross-sectional design, which cannot determine the direction of causal relationships. Second, the study recruited patients from primary healthcare centers belonging to the Ministry of Health, which limits the generalizability of results over other healthcare disciplines in Muhayel City.

## Conclusion

Inadequate knowledge and poor practice of foot care are common among recently diagnosed diabetic patients in Muhayel City, Aseer Region, KSA and they are associated with each other. Younger patients (20-30 years), patients without cardiac diseases and those with HbA1c <7% are more likely to express good foot care practice than their counterparts. Most patients get their feet examined by a physician and most of them receive health education from their physicians regarding the importance of foot care and how to perform it. However, less than half of patients receive health educational brochures about foot care.

## Recommendations

It is necessary to organize educational programs at primary healthcare centers, diabetes centers and hospitals for recently diagnosed diabetic patients focusing on aspects of diabetic foot care in order to reduce the burden of diabetic foot complications. Physicians, particularly those at primary care centers, nurses and health educators need to be encouraged, to play an active role in the health education program. Diabetic patients should receive regular check-up for their feet in order to early detect and manage any abnormality and to prevent diabetic foot. This check-up should be done at home and hospitals, based on evidence-based guidelines. Effective control of diabetes, as it is associated with better foot care practice.

## References

- Edmonds ME, Foster AVM, Sanders LJ. A practical manual of diabetic foot care. Malden, Blackwell Publ, 2008.
- Shearman CP. Management of diabetic foot complications. London, Springer-Verlag, 2015
- Hanson EA. Diabetic foot care: a guide for patients and healthcare professionals. Hobart, N.Y., Hatherleigh, 2011
- Veves A, Giurini JM, Guzman RJ. The diabetic foot: medical and surgical management. Switzerland, Humana Press, 2018
- Al-Asmary AS, Mostafa OS, AL-Khaldi YM. Diabetic patients' knowledge and practice regarding prevention of diabetic foot. Med J Cairo Univ. 2013;81:197–205.
- Pourkazemi A, Ghanbari A, Khojamli M, Balo H, Hemmati H, Zakiyeh Jafaryparvar Z, et al. Diabetic foot care: knowledge and practice. BMC Endocrine Disorders. 2020; 20:40 <https://doi.org/10.1186/s12902-020-0512-y>
- Saber HJ, Daoud AS. Knowledge and practice about the foot care and the prevalence of the neuropathy among a sample of type 2 diabetic patients in Erbil, Iraq. J Family Med Prim Care. 2018 Sep-Oct; 7(5): 967–974. doi: 10.4103/jfmpc.jfmpc\_163\_18.
- Desalu OO, Salawu FK, Jimoh AK, Adekoya AO, Busari OA, Olokoba AB, et al. Diabetic foot care: Self-reported knowledge and practice among patients attending three tertiary hospital in Nigeria. Ghana Med J. 2011;45:60–5.
- Gautam A, Bhatta DN, Aryal UR. Diabetes related health knowledge, attitude and practice among diabetic patients in Nepal. BMC EndocrDisord. 2015; 15(1):25. <https://doi.org/10.1186/s12902-015-0021-6>.
- Kafaie P, Noorbala MT, Soheilikhah S, Rashidi M. Evaluation of patients' education on foot self-care status in diabetic patients. Iran Red Crescent Med J. 2012;14:829–32.

11. Kim A, Hongsranagon P. Preventive behaviors regarding foot ulcers in diabetes type II patients at BMA health center no. 48, Bangkok, Thailand. *J Health Res.* 2008;22(suppl):21–8.
12. Ralineba T, Netshikweta M, Shilubane N. Knowledge and practices associated with diabetes among patients with chronic diabetes mellitus in rural areas of Vhembe District, Limpopo Province, South Africa. *J Hum Ecol.* 2015;51:193–201
13. Muhammad-Lutfi AR, Zaraihah MR, Anuar-Ramdhan IM. Knowledge and practice of diabetic foot care in an inpatient setting at a tertiary medical center. *Malaysian Orthopaedic Journal* 2014. 8(3):22-26Doi: <http://dx.doi.org/10.5704/MOJ.1411.005>
14. Akhtar R, Tom C. Perceptions about foot complications among people with recently diagnosed diabetes. *The Diabetic Foot Journal* 2010; 13(4):170-176
15. Al-Khalidi YM. Footcare among male diabetics in family practice center, Abha, Saudi Arabia. *J Family Community Med.* 2008 Sep-Dec; 15(3): 103–106.
16. Hamidah H, Santhna LP, Ruth Packiavathy RD, Suraya AM, Yap WC, Samsiah M, et al. Foot care strategy for the recently diagnosed DM Type 2 patients with low educational and socio-economic background: a step towards future. *Clin Ter.* 2012 Nov;163(6):473-8.
17. George H, Rakesh P, Krishna M, Alex R, Abraham VJ, George K, et al. Foot care knowledge and practices and the prevalence of peripheral neuropathy among people with diabetes attending a secondary care rural hospital in Southern India. *J Family Med Prim Care.* 2013;2:27–32.
18. Al-Hariri MT, Al-Enazi AS, Alshammari DM, Bahamdan AS, AL-Khtani SM, Al-Abdulwahab AA. Descriptive study on the knowledge, attitudes and practices regarding the diabetic foot. *J TaibahUniv Med Sci.* 2017;12:492–6.
19. Begum S, Kong-In W, Manasurakan J. Knowledge and practice of prevention of foot ulcer among patients with diabetes mellitus. The 2nd International Conference on Humanities and Social Sciences April 10th, 2010 Faculty of Liberal Arts. Prince of Songkla University Palliative Care. 2010:1–12.
20. Mustafa A, Iqbal M, Parvez MA. Assessment of knowledge, attitude and practices of diabetics regarding their foot care. *Age.* 2017;40:4.4.
21. Khamseh MI, Vatankhah N, Baradaran HR. Knowledge and practice of foot care in Iranian people with type 2 diabetes. *International Wound Journal* 2007; 4(4):298-302.
22. Saleh F, Mumu SJ, Ara F, Begum HA, Ali L. Knowledge and self-care practices regarding diabetes among recently diagnosed type 2 diabetics in Bangladesh: A cross-sectional study. *BMC Public Health.* 2012;12:1112.
23. Chiwanga FS, Njelekela MA. Diabetic foot: Prevalence, knowledge, and foot self-care practices among diabetic patients in dares Salaam, Tanzania – A cross-sectional study. *J Foot Ankle Res.* 2015;8:20.
24. Perera D, De Silva R, Perera W. Knowledge of diabetes among type 2 diabetes patients attending a primary health care clinic in Sri Lanka/Connaissancesur le diabète chez des patients diabétiques de type 2 consultant dans un centre de soins de santé primaires au Sri Lanka. *Eastern Med Health J.* 2013;19:644.