

Detection of Risk for Foot Ulceration and its Relation to Foot self-Care among Diabetic Elderly Patients

Rokaia Fathi Mohamed¹, Eman Fadl Abd-Elkhalik², Moustafa Tag El-Melook Saad³,
Heba Mohamed Fahmy⁴

1. Assistant Professor of Medical Surgical Nursing (Gerontological Nursing), Faculty of Nursing, Minia University. Egypt.
2. Assistant Professor of Medical Surgical Nursing, Faculty of Nursing, Minia University. Egypt.
3. Lecturer of Gerontological Nursing, Faculty of Nursing, Mansoura University. Egypt.
4. Assistant professor of Gerontological Nursing, Faculty of Nursing, Assuit University. Egypt.

Email: doctor.rokaia83@gmail.com tel: 01094838686

Abstract:

Most amputations are caused by foot ulcers among diabetic older adults, so it is essential to identify people who are at risk as early as possible. **Aim:** To detect the risk of foot ulceration and its relation to foot self-care among diabetic elders. **Design:** A descriptive research design was conducted on **300 elderly patients** with a type II of diabetes from the outpatient clinic and medical department of Minia University Hospital, Egypt. **Tools:** Demographic characteristics, medical data, and two research instruments were used: (1- Standardized INLOW'S 60s diabetic foot screening tool. 2) Nottingham Assessment of Functional Foot Care Scale (NAFFC). **Results:** The mean age was (71.36±6.835) and 60% were male. Foot examination using Inlow's 60s screening scale reflected that 62.6% and 22% of the participants were at moderate and high risk for foot ulcers respectively. Additionally, 60.7% of them had a low adherence level to foot self-care practices, with a negative correlation between patients' risk of foot ulceration and their adherence to foot care ($p < .000$). **Conclusion:** Around half of the studied sample was detected at risk for foot ulceration between moderate and high levels and more than half of them had a low adherence level to foot self-care practices with a negative correlation found between them. **Recommendations:** Health care providers should emphasize regular foot screening along with proper education for diabetic elderly patients to detect the risky cases of DFUs at an early stage and consequently prevent foot complications.

Keywords: Diabetic elderly patient, Foot ulceration, Risk assessment, Foot self-care.

Receive Date :3 /5/2024

Accept Date: 16 /5/2024

Publish Date :1/6/2024

Introduction:

Diabetes mellitus (DM) is a growing global health problem especially type II which associated with marked morbidity, mortality, and hospitalization rates, particularly among older adults (1). According to the International Diabetes Federation, 463 million people worldwide have diabetes, with 79.4% of those individuals coming from low- and middle-income nations. By 2035, it's predicted that this figure will rise to 592 million (2).

Nowadays, there is an increase in elderly people (≥ 65 years) with diabetes, with an estimation of 33% of all diabetics worldwide. According to the projections, it will increase to 276.2 million by 2045 and 195.2 million by 2030 (3). The likelihood of developing diabetic complications among older adults is associated with longer diabetes duration, the cumulative effects of hyperglycemia, and a higher incidence of micro- and macro vascular problems (4).

DM known as a chronic metabolic disorder, results in elevated blood glucose level due to either insufficient insulin or a failure to respond to insulin. Long-term unsuccessful glycemic control can lead to micro- and macro vascular problems, which increase the morbidity and mortality rates among diabetics, particularly in the elderly (5). One of the top ten nations with the highest percentage of diabetics is Egypt. It was estimated that the prevalence of type 2 diabetes mellitus among the elderly population over 65 years of age was approximately 32.4% (3).

DFU is the most serious of several foot issues that can develop as a long-term consequence of diabetes mellitus. Foot injuries occur prior to 85% of non-traumatic amputations in people with diabetes (6). According to Katherine et al. (7), a lower limb is lost every 30 seconds globally, and over 25% of diabetics will develop a foot ulcer during their lifetime.

Foot ulceration is known as a breakdown of the skin on the foot (including the ankle) that causes open sores or lesions that can become infected and take a long time to cure (8). According to Astasia-Picado et al. (9), the lifetime risk of foot ulceration among diabetic elderly exceeds 19% to 34%. The incidence of foot ulceration associated with multiple negative consequences among older adults included functional disabilities, recurrent hospitalization, emotional distress, caregiver burden, reduced quality of life, amputation, and death (10).

Patient's foot self-care adherence was identified as an essential issue to prevent foot complications among diabetic elders, included; hygienic practices, daily foot examination, toenail care, appropriate foot wear, and rapid cure for minor injuries. These practices can diminish the hazard of foot ulcers by fifty percent and the danger of amputations by up to 85% (11).

Gerontological nurses as a core of the health team should direct their efforts toward Prevention and early detection of DFUs through regular foot examination using standardized screening tools in all health care settings for the early identification of high-risk patients, the prevention of DFU development, prompt referrals for additional care, and the decrease in the prevalence rate of amputations (8).

Significance of the study:

Diabetic foot ulceration (DFUs) denotes a real challenge to health providers caring for diabetic elderly patients. Accordingly, preventive care practices include; early identification of high risk cases, early diagnosis and intervention are crucial to improve patients' outcomes, minimize the economic burden on patients and their caregivers, and limit further deterioration into amputation (8).

According to an Egyptian study; the DFUs represented 29.3% of diabetic patients and most of them were elderly people (12). On the other hand, the related literatures by (8 & 11) reported that regular screening and early identification of diabetic patients at risk for foot ulceration integrated with patients' compliance with foot care were effective in the prevention of diabetic foot ulceration,

improving patients' quality of life, and consequently reported a lower incidence of amputations among them.

In light of this review, the researchers observed that data on risky elderly people for foot ulceration are missing and the screening of the risky people was rarely reported in the outpatients of diabetes, with limited conducted studies focusing on this health issue in our geographical area. So, this research had been established to stratify patients into risk categories, identify their foot self-care behaviors and the relation between both, in order to plan the needed future educational intervention.

Aim of the Study

The current study aimed to:

Detect the risk of foot ulceration and its relation to foot self-care among diabetic elderly patients.

Research questions:

Q1-What is the risk of foot ulceration among the studied sample?

Q2-What is the adherence level to foot self-care practices among diabetic elderly patients?

Q3-If there is a relation between the foot ulceration risk and self-care practices among the studied patients?

Q4- What are the associated factors that affect foot ulceration risk and adherence level to foot self-care practices among the studied patients?

Subjects and Methods

Research Design:

A descriptive research design was utilized to fulfill the aim of this study.

Setting:

This study was carried out in the medical outpatient clinic and medical department at Minia University Hospital which affiliated to Minia Governorate, Egypt.

Sample size:

A purposive sample of 300 elderly patients with type II diabetes mellitus of both gender (males & females). The sample size was calculated based on Issac and Michael (1995) formula which is computed as $(N=n \times 30/100)$ in which:

N=Sample size

n= Total number of diabetic elderly patients admitted to Minia university hospital during the period (2021:2022).

$N=1000 \times 30/100=300$ patients

Inclusion Criteria:

1. Patients 60 years and more with type II diabetes mellitus of both sexes.
2. Patients who were able to communicate.

Exclusion Criteria:

1. Patients who refused to participate in the current study.
2. Cases with Previous or recent diabetic foot ulcer.

Data Collection Tools:

Three tools will be utilized for data collection of the current study.

Tool I: A structured questionnaire sheet: prepared by the researcher and included the two following parts:

- **Part 1: Personal characteristics** such as patient's age, gender, education, residence, and occupation, income, and living condition.
- **Part 2: Medical profile included:**
 - ✓ Date of admission, duration of diabetes mellitus, presence of chronic diseases plus DM, medication used, and smoking.
 - ✓ Weight and height measurement to estimate body mass index (weight in Kg, divided by the square of height /m²) Equation.
 - ✓ Blood test (HbA1c) to assess glycemic control over three months.

Tool II: Standardized INLOW'S 60s diabetic foot screening tool, developed by (13). This scale used for assessing the risk of foot ulcers among diabetic patients. The examination was conducted by the researchers for each participant through three steps (look & touch, and assess). **1)** In the first 20 seconds, the investigator looked at the foot appearance involved (the state of the skin, nails, bone deformities, and footwear. **2)** In the next 10 seconds, the researcher touched foot temperature (cold & hot) and range of motion. **3)** In the last 30 seconds; pedal pulses, dependent rubor, and sensation (Monofilament Testing and four questions) were evaluated. The researcher excluded 5 points from the scale were; the presence of (open ulceration, damaged, infected nails, major bone deformity, hallux amputations, and erythema) as they are linked with the presence of actual foot ulcerations, which were already excluded in our study. The total score of the scale parameters we used ranges from 0 to 19.

Scoring system:

The greatest score from either the left or right foot was utilized to interpret the results of this scale, as follows:

Score	Level of risk	Recommendation
A score of 0 to 6	Low risk	For patients in this group, a foot exam was advised once every 12 months.
A score of 7 to 12	Moderate	Foot Screening is recommended each 6 months.
A score of 13 to 19	High	Screening recommended every 3–6 months.

Tool III: Nottingham Assessment of Functional Foot Care Scale (NAFFC): It is adapted from (14) to assess the level of foot self-care adherence among diabetic patients. The original one consisted of 26 items and abbreviated by (15) to be seventeen items based on the different socioeconomic status of the participants. Every question of those self-reported questions was categorized from (0–3) according to the frequency of actual behavior. A score of ≤ 50 indicated poor adherence level to foot self-care.

Content validity and reliability:

Three experts—one from academic internal medicine and two from academic medical-surgical nursing and geriatric nursing staff reviewed the study tools for clarity, validity, and comprehensiveness. Cronbach's alpha coefficient used to measure the consistency of the study tools. The reliability was (0.897), (0.61) (0.86) for the structured interview questionnaire, foot self-care scale and INLOW'S 60 s scale respectively which indicated good reliability.

Ethical Consideration

- The participants' informed written consent had obtained.
- The right to refuse participation in the study, as well as privacy, confidentiality, and anonymity had been guaranteed.
- The faculty of nursing's ethical committee approval to establish the research was taken.
- The director of Minia University Hospital gave permission to carry out the study.
- Subjects were free to refuse sharing in the study or to leave at any moment, for any reason.

Pilot study:

A pilot study was done on 10 % of the total sample to test the feasibility and the applicability of the study instruments. They included in the study because there was no vital modifications needed to be done.

Field of the work:

- Firstly, to conduct this research, the official agreement was obtained from the nursing institute's ethical committee and from the director of Minia University Hospital. Then, the researcher met the head of the out-patient clinic and department for diabetic patients, the head nurse, physician, and staff to provide details about the research project; as well as ask for help and support.
- The study took six months; it began in August, 2023 and ended in January, 2024. The researchers scheduled three days a week for data collection. Patients who achieved the inclusion criteria were enrolled voluntarily and perceived the explanation about the purpose of the study. After that a written informed consent was obtained.
- In order to collect the data; a face-to-face interview with the participants at the previous mentioned settings was done. Firstly, the researchers collected the initial personal data like (sex, age, education, marital status, monthly income, etc.), and then the medical data was reported, included (presence of comorbidities, diabetes duration, medication used, body BMI, the level of glycemic control, etc.) which took about 10-15 minutes. After that, the foot self-care adherence level was measured using the Nottingham Foot Care scale which included (17) self-reported questions about the actual foot care behavior. It took about 10-15 minutes according to the patients' responses.
- Finally, the authors examined both right and left foot for each participant using the Inlow's screening scale to find out the risk for DFUs by direct observation, inspection and palpation methods. Skin status, nails condition, bone deformity, and footwear status were assessed by inspection method, then foot temperature (cold & hot), range of motion, pedal pulsation were tested by palpation method, and Peripheral perfusion and capillary refill were assessed by a dependent rubber test. Added to, the sensation was examined by performing the monofilament testing and asking sensation-related specific four questions. The highest score from the right or left foot examination reflected low risk for FUs.

Data analysis

In order to organize, categorize, and analyze the data that had been gathered, the statistical package for social studies (SPSS) version 20 was used. For presenting the qualitative variables, descriptive statistics in the formula of frequencies and percentages was applied, while mean and standard deviations were used for quantitative variables. Also, the data was managed and compared using the Chi-square and the independent sample T-test, with the significance level accepted at a p-value of < 0.05 .

Results

Table (1): Percentage distribution of the studied sample according to their personal data (no=300).

Items	Patients (no.= 300)	
	no.	%
Age		
• 60-<65yrs.	94	31.3
• 65-70yrs.	91	30.3
• >70yrs.	115	38.4
Mean ± SD	71.36±6.835	
Marital statuses		
• Married	178	59.3
• Separated	18	6
• Widow	104	34.7
Gender		
•Male	180	60
•Female	120	40
Residence		
• Rural	176	58.7
• Urban	124	41.3
Educational level		
• Low	143	47.7
• Medium	67	22.3
• High	90	30
Occupation		
•Retired	58	19.3
•Free work	49	16.3
• No work	38	12.7
•Farmer	67	22.3
•House wife	88	29.3
Living condition		
• Living alone	92	30.7
•Living with family	199	66.3
•Living in Nursing home	9	3
Monthly income		
•Insufficient	195	65
•Sufficient	105	35

Table (1): Showed distribution of studied sample personal data. It reflected that low education, living in rural areas, being married, male sex, and having insufficient income took the highest

percentages of (47.7%, 58.7%, 59.3%, 60% and 65%) respectively, with a mean age of (71.36±6.835).

Table (2): Percentage distribution of the studied sample according to their medical data (no.=300).

Items	Patients (no.= 300)	
	no.	%
Presence of chronic disease added to diabetes ≠		
• Yes	185	61.7
• No	115	38.3
Number of chronic disorders		
• Two or less	143	47.7
• more than two	157	52.3
Hypertension		
• Yes	135	45
• No	165	55
Liver disorders		
• Yes	45	15
• No	255	85
Renal disorders		
• Yes	11	3.7
• No	289	96.3
Cardiovascular disorders		
• Yes	122	40.7
• No	178	59.3
Musculoskeletal disorders		
• Yes	68	22.7
• No	232	77.3
Respiratory diseases		
• Yes	97	32.2
• No	203	67.7
Cancer		
• Yes	8	2.7
• No	292	97.3
Duration of Diabetes		
• <10yrs	115	38.3
• ≥10yrs	185	61.7
Current treatment		
• Insulin	274	91.3
• both	26	8.7
Body mass Index (BMI)		
• Normal	129	43
• Over weight	39	13
• Obese	90	30
• Over obese	42	14
Glycemic control		
• Uncontrolled	195	65
• Controlled	105	35
Smoking habit		
• Yes	34	11.3
• No	266	88.7

≠ means more than one answer

Table (2): Displays the medical profile of the participants. It illustrated that 52.3% of them had more than two chronic diseases in addition to diabetes. Hypertension, cardiovascular, and

respiratory diseases represented the highest percentages (45%, 40%, and 32.2%) respectively. Also, results reveal that 61.7 % of the participants had diabetes for more than ten years, most of them (91.3%) are on insulin treatment, (30%) and (65%) of them represented obesity and no glycemic control respectively.

Table (3): Percentage distribution of the studied sample according to their foot examination by Inlow's-60s screening scale.

Parameters of Inlow's 60 second foot screening scale	Right foot		Left foot	
	No	%	No	%
1-Skin condition				
Intact and healthy	94	31.3	89	29.7
Dry skin	122	40.7	136	45.3
Corns and callous build up	84	28	75	25
2- Nail status				
Well groomed	89	29.7	65	21.7
Unwell and ragged	126	42	174	58
Thichy	85	28.3	61	20.3
3-Foot deformity				
No deformity	220	73.3	200	67.7
Mild	80	27.7	100	33.3
4-Sensation (Monofilament testing)				
All 10 sites detected	180	60	158	52.7
7-9 sites detected	120	40	142	47.3
Sensation involved four inquiries: 1) Do the feet ever become numb? 2) Do your foot ever tingle? 3) Do they ever burn? and 4) Have they ever had the feeling that insects are swarming them?				
No for all four questions	188	62.7	168	56
Yes to any of questions	122	37.3	132	44
5-Peripheral pulsation				
Pedal pulse				
Present	240	80	222	74
Absent	60	20	78	26
Dependent rubor				
Present	245	81.7	240	80
Absent	37	18.3	60	20
6-Foot temperature				
Normal (Foot is warm)	265	88.3	217	72.3
Abnormal (Foot is cool)	35	11.7	83	27.3
7-Range of motion				
Full range to hallux	140	46.7	125	41.6
Hallux limitus	60	20	65	21.7
Hallux rigidus	100	33.3	110	36.7
8-Foot wear status				
Appropriate	160	53.3	160	53.3
Inappropriate	140	46.7	140	46.7

Table (3): Reflects the foot assessment results using the Inlow's parameters scale, it was found that the left foot represented higher percentages of risk than the right foot. The most noteworthy results were; the left foot's skin was dry in 45.3% of the subjects. According to nail examination, 28.3% and 58% of the patients had ragged toenails at the right and left foot respectively. In 26 percent of patients, there was no pedal pulse in the left foot. In addition, 27.3% and 46.7% of the studied sample their left foot was cool and had inappropriate foot wear, respectively.

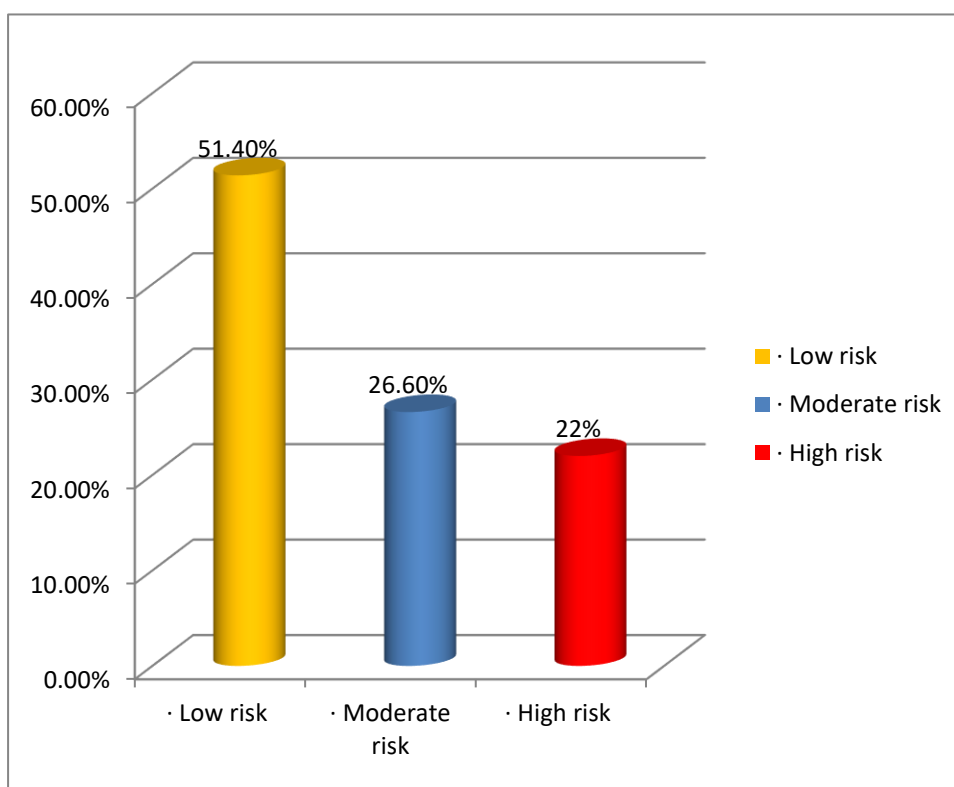


Figure (1): The risk levels of foot ulceration among the studied sample (N=300).

Figure (1) displays the risk categories of foot ulceration among the studied sample. It reveals that (51.4%, 26.6%, and 22%) were at low, middle, and high risk for foot ulceration, respectively, based on the physical examination for both feet using the Inlow's foot screen scale. The recommended screening should be done for them every 12 months, 6 months, and 3 months, according to their risk level respectively. It answered the first research question.

Table (4): Percentage distribution of the participants according to their self-reported foot care behaviors (no.=300).

Self-reported foot care behaviors								
	no.	%	no.	%	no.	%	no.	%
1. Examination of feet regularly	Once a week		2-6 time a week		Once a day		More than once a day	
	119	39.7	61	20.3	11	3.7	109	36.3
2. Checking the shoes before putting them on	Never		Rarely		Sometimes		Often	
	105	35	75	25	68	22.7	52	17.3
3. Check the shoes when taking them off	Never		Rarely		Sometimes		Often	
	106	35.3	71	23.7	96	32.2	7	9
4. Washing the foot	A few days a week		Most days a week		Once a day		More than once a day	
	89	29.6	73	24.3	50	16.6	88	29.2
5. Drying between toes after washing	Never		Rarely		Sometimes		Often	
	110	36.7	68	22.7	69	23	53	17.7
6. Using of moisturizing cream on feet	Never		Rarely		Sometimes		Often	
	230	76.7	40	13.3	27	9	3	1
7. Putting moisturizing cream between toes	Daily		Weekly		Monthly		Never	
	77	25.7	16	5.3	11	3.7	196	65.3
8. Cutting the toenails	Never		Less than once a month		Once a month		Once a week	
	71	23.7	0	0	145	48.3	84	28
9. Wearing the shoes without socks/stockings	Often		Sometimes		Rarely		Never	
	78	26	95	31.7	63	21	64	21.3
10. Changing your socks/stockings.	<4 times a week		4 to 6 times a week		Daily		>Once a day	
	82	27.3	84	28	78	26	56	18.7
11. Walking outside in bare feet.	Often		Sometimes		Rarely		Never	
	80	26.7	85	28.3	15	5	120	40
12. Putting the feet near the fire.	Often		Sometimes		Rarely		Never	
	12	4	112	37.3	52	17.3	124	41.3
13. Examining water temperature before washing feet.	Never		Rarely		Sometimes		Often	
	80	26.7	121	40.3	40	13.3	59	19.7
14. Applying a dry dressing on a blister when you get one.	Never		Rarely		Sometimes		Often	
	12	4	116	38.7	82	27.3	90	30
15. Applying a dry dressing on cuts or burned areas when you get one.	Never		Rarely		Sometimes		Often	
	8	2.7	122	40.7	114	38	56	18.6
16. Using corn remedies/corn plasters/paints when getting a corn.	Often		Sometimes		Rarely		Never	
	46	15.3	111	37	81	27	62	20.7
17. Putting your feet on a radiator.	Often		Rarely		Sometimes		Never	
	18	6	79	26.3	79	26.3	124	41.3

Table (4): Displays self-reported foot care among the studied sample. It was reported that 39.7% and 35% of the participants didn't examine their feet daily and didn't check their shoes

before wearing them, respectively. Additionally, 36.7% and 40.7% of them, respectively, did not dry the space between their toes after washing their feet and infrequently used clean dressings to treat cuts or injuries. In addition, only 18.7% and 40% of the patients changed their socks every day and never went outside barefoot, respectively.

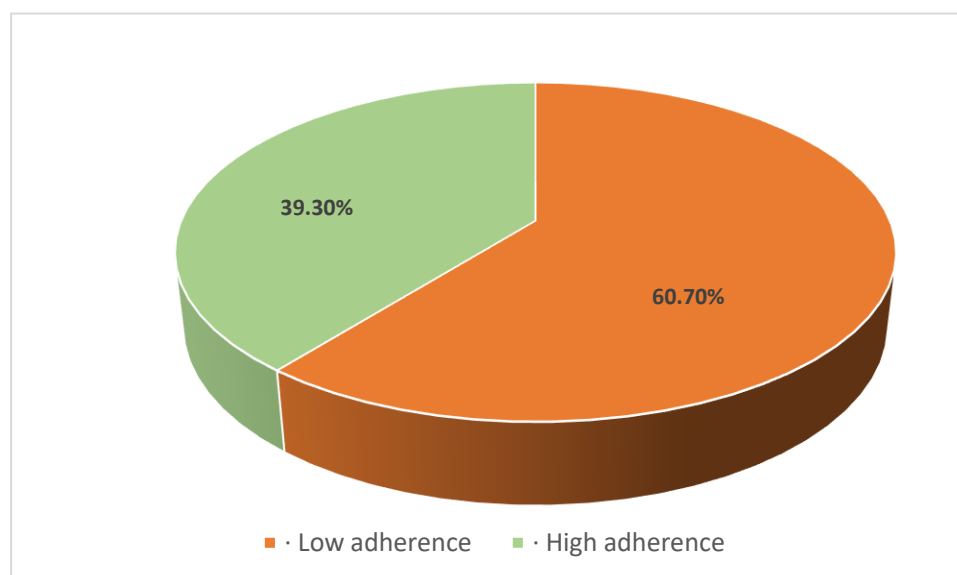


Figure (2): Percentage distribution of foot self-care adherence among the studied sample (N=300)

Figure (2): Represents the adherence level for foot self-care among the studied sample. It reveals that 60.7% of them had low adherence level to foot self-care practices. This figure answered the second research question.

Table (5): Correlation between foot ulceration risk and adherence to foot self-care among the studied sample (no.= 300).

Items		Adherence to foot self-care
foot ulceration risk	R	.889-**
	P- value	.000

Table (5): Illustrates that there was a negative correlation between the adherence to foot self-care and the risk of developing foot ulceration among the studied sample with a high statistical significance difference ($p=0.000$).

Table (6): The relation between patients' personal data and the mean score foot self-care adherence among the participants (no.= 300).

Items	Patients (no.= 300)	
	Mean	±SD
Age		
• 60-<65yrs.	44.37	3.77
• 65<70yrs.	23.00	12.4
• >70yrs.	32.01	6.71
F -test (P-value)	141.6(.000**)	
Marital statuses		
• Married	27.07	14.62
• Separated	32.61	16.11
• Widow	23.01	15.20
F -test (P-value)	4.31(.014*)	
Gender		
•Male	23.38	14.88
•Female	29.81	14.59
T-test (P= value)	3.70(.000**)	
Residence		
• Rural	14.23	4.41
• Urban	43.17	5.70
T-test (P= value)	49.44(.000**)	
Educational level		
• Low	13.95	3.94
• Medium	27.71	14.8
• High	43.87	4.12
F -test (P-value)	404.1(.000**)	
Occupation		
•Retired	41.70	9.12
•Free work	34.73	15.4
• No work	20.23	9.82
•Farmer	11.28	3.81
•House wife	24.48	12.35
F -test (P-value)	73.84(.000**)	
Living condition		
• Living alone	16.14	10.90
•Living with family	30.32	14.58
•Living in Nursing home	31.22	16.25
F -test (P-value)	34.81(.000**)	
Monthly income		
•insufficient	14.89	5.73
•Sufficient	44.12	3.69
T-test (P= value)	48.55 (.000**)	

Table (6): Shows that there were statistical significance differences between patients' adherence to foot self-care and their (age, sex, educational level, place of residence, monthly income, and living condition). In which the mean score of foot self-care practices were

declined among those who aged (more than 65 years), male, having low educational level and insufficient income, those who are living alone, and coming from rural places.

Table (7): The relation between patients' personal data and the mean score of risk for foot ulceration among participants (no.= 300).

Items	Risk for foot ulceration	
	Mean	±SD
Age		
• 60-<65yrs.	1.51	2.09
• 65-70yrs.	8.53	5.90
• >70yrs.	13.8	4.15
F -test (P-value)	10.8(.000**)	
Marital statues		
• Married	8.26	6.58
• Separated	8.50	4.70
• Widow	8.35	6.21
F -test (P-value)	.014(.986)NS	
Gender		
•Male	7.12	5.50
•Female	9.12	7.25
T-test (P= value)	2.72(.007**)	
Residence		
• Rural	12.8	3.32
• Urban	1.71	3.02
T-test (P= value)	29.5(.000**)	
Educational level		
• Low	13.15	3.40
• Medium	8.58	4.53
• High	0.422	.834
F -test (P-value)	44.6(.000**)	
Occupation		
•Retired	1.79	3.54
•Free work	5.71	4.10
• No work	11.39	5.3
•Farmer	12.67	2.51
•House wife	9.40	7.16
F -test (P-value)	44.69 (.000**)	
Living condition		
• Living alone	11.28	4.20
•Living with family	7.04	6.75
•Living in Nursing home	6.00	4.92
F -test (P-value)	16.15(.000**)	
Monthly income		
•insufficient	12.54	3.87
•Sufficient	1.40	2.01
T-test (P= value)	28.4(.000**)	

Table (7): Shows that there were statistical significance differences between patients' risk for foot ulcer and their (age, sex, educational level, place of residence, living condition and monthly income). In which the risk of developing foot ulcer was higher among those who age group (more than 70 years), male, having low educational level and insufficient income, those who are living alone and coming from rural places.

Table (8): The relation between patients' medical data and their means score of (adherence to self-care & risk for foot ulceration) (no.= 300).

Items	Patients (no.= 300)			
	Adherence to foot self-care		Risk for foot ulcer	
	Mean	SD	Mean	SD
Presence of chronic diseases added to diabetes				
• Yes	14.74	5.36	12.6	3.77
• No	44.11	3.67	1.39	2.01
T-test (P-value)	51.63(.000**)		29.3(.000**)	
Number of comorbidities				
• Two or less	38.64	11.61	3.46	4.59
• more than two	14.49	5.76	12.7	4.09
T-test (P-value)	23.11(.000**)		18.4(.000**)	
Duration of diabetes				
• <10yrs	44.11	3.67	1.39	2.01
• ≥10yrs	14.74	5.36	12.6	12.6
T-test (P-value)	51.63(.000**)		29.3(.000**)	
Body mass index (BMI)				
• Normal	39.25	11.1	2.86	4.23
• Over weight	17.69	6.40	10.1	4.01
• Obese	13.38	7.08	12.7	2.60
• Over obese	14.52	2.23	16.1	1.71
T-test (P-value)	197.6 (.000**)		219.1(.000**)	
Glycemic control				
• Uncontrolled	15.89	5.73	12.54	3.87
• Controlled	43.12	3.69	1.40	2.01
T-test (P-value)	46.55 (.000**)		28.4(.000**)	
Smoking				
• Yes	14.85	13.6	11.38	5.26
• No	27.42	14.6	7.92	6.36
T-test value) (P=	4.74 (.000**)		3.03(.003**)	

Table (8): Reflects that the adherence level to foot self-care had been declined and the risk of developing foot ulceration had been increased among those who had more comorbidities,

longer duration of diabetes, uncontrolled glycemic level, obesity, and smokers' participants, with highly statistically significance differences.

Discussion

Most foot problems that lead to amputations among diabetic older adults are rising from the development of foot ulcers (16). So, routine assessment and early detection of risky patients are top priorities in reducing the incidence of FUs and consequently declining the economic burden of diabetic foot complications (17).

The present appraisal is the first done in Minia Governorate to detect risky diabetic elderly people for developing foot ulceration by using the standardized INLOW'S-60 diabetic foot screening tool, and subjects were examined individually by the researchers through inspection and palpation methods.

Our study included 300 diabetic elderly patients with type II, more than one third of them aged seventy years and more. This can be explained as advanced age considered a great risk for the development of type II diabetes related to the united effects of increasing insulin resistance and diminished pancreatic islet function with aging. This was in agreement with **Azmi et al., (2020)** who found that the vast majority of the studied sample who had type two diabetes were aged more than sixty six years old (18).

As regarding to sex; male sex was the foremost. This was in accordance with **Al-Mohaithef, et al. (2022)** who discussed cigarette smoking making male more liable for diabetes and diabetes related complications than females (19). While disagree with **Amini et al (2023)** who found the prevalence of risk foot ulceration was higher among women with type II diabetes and discussed that it may be related to lifestyle and overweight (20).

It was noticeable that diabetic elders who came from rural places were higher than urban, added to nearly half of them had a low educational level and insufficient income. Parallel findings were informed by studies applied in **Ethiopia (21), Malaysia (22), Egypt (18)** and **Kwalet (23)**. This could be because people are living in rural areas and having lower education having lower health-related knowledge, which leads to unhealthy behaviors. Furthermore, compared to patients living in urban places, those in rural areas have less access to health education, including self-care practices, preventive measures, books, and social media.

As regards medical data; it was reported that more than half of the participants are suffering from chronic disorders added to DM. Hypertension, cardiovascular, and respiratory diseases represented the highest percentages. Added to more than half of the participants had DM for more than ten years with the vast majority on insulin regimen. Similar findings were reported by (24&25) who explained as the prevalence of chronic diseases increases related to cumulated effects of diabetes mellitus.

The risk for foot ulceration:

The main finding of current study was that near to half of the participants were at risk for foot ulcers between moderate to high risk based on the results of INLOW screening tool which consisted of three overall steps (look, touch and assess). The noticeable higher percentages of the scale parameters were (dry skin, ragged nails, inappropriate foot wear, cool foot, bone deformity, Hallux rigidus and absence of pedal pulses. Similar outcomes were described by (1&19).

Based on the findings of performing Monofilament Test, sensation was detected in seven to nine sites for around half of the studied sample and this was an early indicator for the presence of neuropathy. As well as absence of pedal pulse in about one quarter of them with diminished capillary refill was an early indicator of peripheral vascular disease that are major risks for DFUs need proper consultation.

Our view is that aging process is associated with many foot changes, involve; deficiency of elastin and collagen fibers which can trigger hard and plantar surface dryness. As well as, deviations in foot joints, soft tissue and muscle, plus changes in foot size and shape that may affect the shoes fitness. On other hand, Diabetes itself impairs peripheral capillary circulation and causes vascular damage with decreased oxygen supply to the peripheral nerves, all putting older adults at greater risk for FUs, this was matched with (20&26).

There was a positive relation between patients' socio-demographic data and their risk of foot ulcers. In which the hazard was elevated in male diabetic elderly patients, aged seventy years, having low educational level and insufficient income, those who are living alone, and coming from rural places. These results are in accordance with the previous studies of Al-Mohaithef et al., (2022) and Elhgry et al., (2023) (19&25).

This can be discussed as many older adults often live alone and have diminished vision, other co-morbidities that significantly reduce their ability to care for their feet. On the other hand, Upper Egypt, where the research has been established, specifically rural areas characterized by dry climate added to the tradition of walking barefoot there, and limited health resources putting them at a great risk for DFU. Furthermore, the high rate of illiteracy in this age group, especially in rural regions, is typically linked to poor self-care in terms of managing chronic illnesses, taking medication as prescribed, adaptation of a healthy lifestyle, and

realizing the value of routine blood sugar checks, which consequently elevates the risk of DFUs. These findings were supported by previous studies (25, 27, and 28).

In contrast, several previous studies supported our finding and stated that women are less likely to progress DFUs paralleled to males, because of their lower risk of developing neuropathy. Diversely, **Dinh & Veves (2015)** showed that both sexes have an equal risk of ulceration (29). While in **Saudi Arabia (30)**, it was observed that female patients in were more susceptible to DFUs than male patients. We think that other contributing factors rather than a person's sex, determine the risk of having foot ulcers.

On the other hand, our study reflected that a higher risk was observed among those who had more comorbidities, a longer duration of diabetes (more than ten years), uncontrolled glycemic level, obese and smokers' participants. Our opinion is the patients with an uncontrolled blood glucose, and longer period of diabetes most likely to develop peripheral neuropathy and peripheral artery disease as long-term complications, and this fact was supported by (27&31). Also, **Clair et al., (2015)** stated that smoking habit is linked with the threat of diabetic foot ulceration and explained that smoking depresses the sensitivity to medications of diabetes and raises the accidental of emerging complications (32).

Adherence to foot self-care and it's relation to the risk for foot ulceration among the studied sample

Adherence to foot self-care is a key issue in reducing the risk for foot ulcer. In our study we investigated that adherence level by using the Nottingham Assessment of Functional Foot care. As well as evaluated its relation to FU risk among the diabetic elderly participants. It was recorded that about sixty percent of subjects had low adherence to foot self-care. The highest reported behaviors were (they didn't examined their feet daily, didn't check their shoes before wearing, didn't dry between their toes after washing their feet, they rarely use clean dressing when they are getting cuts or injuries didn't change their socks daily and walk barefoot around and outside their house).

These findings were in consistent with **Bekele et al., (2022)** who found more than half of the studied sample had poor self-care practices (33). Also, these findings were similar to the findings of **El-Sedawy and Behairy, (2016) (34)**. However, they were against the studies conducted in **Sudan (21)** and **Ethiopia (35)** who reported higher level of foot care among participants.

The existing study also exhibited the mean score of foot care practices were decreased among those with advanced age male, having low educational level and income, those who are living alone and coming from rural places with statistical significance differences. Those

findings were greatly supported by (36&37). Researchers discussed as low education among this age group and low socioeconomic status in rural places of Upper Egypt, added to living alone can result in deficiency of patients' alertness about self-care, lack of supported materials, and shortage of contact to health facilities.

Concerning the correlation between foot ulceration risk and adherence to foot care among the studied sample, there was a negative correlation between both with a statistical significance difference. These findings matched with (38) who demonstrated that the majority of diabetic patients diagnosed with foot ulcers had lowly awareness regarding diabetic foot care. However, another study reflected that peripheral vascular disease and neuropathy were the greatest predictors of FUs (40).

Finally, concurrent study investigated the medical factors associated with low adherence to foot care and high risk for FUs. These predictors were (having more chronic diseases, longer duration of diabetes, uncontrolled glycemic level, obesity and smoking, with highly statistically significance differences. Similar findings were found by (25&41).

In the same line with our proposal, **Mousavi et al. (2023)** revealed that co-morbidities specifically cardiovascular disorders among diabetic patients are greater risk factor for DFUs and responsible for fifty percent of lower amputation (42). Also, many previous related literatures confirmed that elderly individuals with diabetes for more than 15 years are more prone to diabetic foot ulcers with a significant relationship (43&44).

Limitations of the study:

As a result of inaccessibility of detail information at the outpatient clinic records, the analysis for few variables could not be done for diabetic patients.

Conclusion:

Based on the systematic review that has been carried out, nearly half of the studied sample was detected at risk for foot ulceration between moderate and high levels and more than half of them had a low adherence level to foot self-care practices, with a negative correlation found between them. Added to, advanced age, male sex, low educational level and income, living alone, rural residence, more comorbidities, longer duration of diabetes, and uncontrolled glycemic level all are detected factors that increase the risk of foot ulceration and lower foot self-care adherence among diabetic elders.

Recommendation

- 1) There is an urgent need for designing educational programs for diabetic elderly patients and their caregivers about proper foot care and predisposing factors of getting (DFU) regardless of their level of risk for foot ulcers.
- 2) The role of health care providers should not be limited to the treatment of DFUs, but should also extend to provide the effective prophylactic measures through regular screening and early detection of risky group, along with proper patient education.
- 3) Emphasize the importance of the foot examination as a core component of clinical skills using standardized assessment tools for screening the risk for DFUs to be performed as a routine part of clinical examination in each visit for diabetics for early detection, proper management, and consequently limit the amputation rates.
- 4) Providing educational sessions for newly registered nurses about how to examine diabetic foot included (vascularity, sensation, integrity, and pulsation).
- 5) Replication of the current study on a larger sample from different geographical areas should be done to achieve generalization of the results
- 6) Further studies needed to be conducted using further investigation methods for early detection of neuropathy and peripheral vascular disease among diabetic elders and to be intervention in nature.

References

1. Zantour B., Bouchareb S., El Ati1, Z., Boubaker F., Alaya W., Kossomtini W., & Sfar M. (2020). Risk assessment for foot ulcers among Tunisian subjects with diabetes: a cross sectional outpatient study *BMC Endocrine Disorders*. 20:128. <https://doi.org/10.1186/s12902-020-00608-2>.
2. International Diabetes Federation (IDF). (2019). *IDF Diabetes Atlas (9th ed)*. Retrieved from <https://www.idf.org/e-library/epidemiology-research/diabetes-atlas/159-idf-diabetes-atlas-ninth-edition-2019.html>.
3. Ghazi H. (2022). The Situation Among Egyptian Elderly with Type 2 Diabetes; A Call for Action. *The Egyptian Journal of Hospital Medicine*, 89(1), 4611-4616.
4. Francisco, P. M., Assumpção, D. D., Bacurau, A. G. , Silva, D. S., Yassuda, M. S. & Borim, F. S. (2022). Diabetes mellitus in older adults, prevalence and incidence: results of the FIBRA study. *Revista Brasileira de Geriatria e Gerontologia*, 25.
5. Li S, Wang J, Zhang B, Li X, & Liu Y. (2019): Diabetes mellitus and cause-specific mortality: a population-based study. *Diabetes Metab J.*; 43:319–341.
6. Stancu, B., Ilyés, T., Farcas, M., Coman, H. F., Chiş, B. A., & Andercou, O. A. (2022). Diabetic Foot Complications: A Retrospective Cohort Study. *International Journal of Environmental Research and Public Health*, 20(1), 187.

7. Katherine Mc, Michael F., Andrew J.M. Boulton S., & Caitlin W. (2023). Etiology, Epidemiology, and Disparities in the Burden of Diabetic Foot Ulcers. *Diabetes Care* 2 January 2023; 46 (1): 209–221. <https://doi.org/10.2337/dci22-0043>.
8. Pham, H., Armstrong, D.G., Harvey, C., Harkless, L.B., Giurini, J.M., & Veves, A., (2020). Screening techniques to identify people at high risk for diabetic foot ulceration: a prospective multicenter trial. *Diabetes Care* 23 (5), 606–611. <https://doi.org/10.2337/diacare.23.5.606>.
9. Astasio-Picado, Á., Toledano, V. G., López-Sánchez, M., Jurado-Palomo, J., Cobos-Moreno, P., & Gómez-Martín, B. (2022). Management of the Diabetic Foot in People with Diabetes Mellitus Older than 65 Years. *Applied Sciences*, 12(20), 10279.
10. American Diabetes Association, 2019. Microvascular complications and foot care: standards of medical care in diabetes, 2018. *Diabetes Care* 41 (S1), S105–S118. <https://doi.org/10.2337/dc18-S010>.
11. Elkashif M., Mahdy A., and Elgazzar S., (2021). Evaluating The Effect of Establishing Protocol for Self- Care Practice of Diabetic Foot Patients Regarding Their Needs, Concerns and Medication Use: A quasi-experimental study. *Saudi Journal of Biological Sciences* 28 3343–3350.
12. Hassan, A. K., Aly, S. E., Mohammed, F. M., Diab, T. M., Sayed, S. Y., Abd-Elsalam Elhgy, G. M. & Eldeen, M. E. (2021). Impact of Health Intervention about Foot Self-Care Behavior among Adult and Elderly Diabetic Patients'. *Assiut Scientific Nursing Journal*, 9(27), 92-104.
13. Inlow S., (2004). The 60-second foot exam for people with diabetes. *Wound Care Canada*; 2: 10–11.
14. Lincoln NB, Jeffcoate WJ, Smith M, Radord KA (2007) Validation of a new measure of protective footcare behaviour: The Nottingham Assessment of Functional Footcare (NAFF). *Pract Diabetes Int* 24:07–11.
15. Mekonen EG, Gebeyehu Demssie T. (2021). Preventive foot self-care practice and associated factors among diabetic patients attending the university of Gondar comprehensive specialized referral hospital, Northwest Ethiopia. *BMC Endocr Disord*. 2022 May 11;22(1):124. doi: 10.1186/s12902-022-01044-0. PMID: 35546665; PMCID: PMC9097232.
16. Akila M, Ramesh RS, Kumari MJ. (2021). Assessment of diabetic foot risk among diabetic patients in a tertiary care hospital, South India. *J Edu Health Promot* 2021; 10:14.
17. Abdissa, D., Adugna, T., Gerema, U., & Dereje, D. (2020): Prevalence of diabetic foot ulcer and associated factors among diabetic patients on follow-up clinic at Jimma Medical Center, Southwest Ethiopia, 2019: an institutional-based cross-sectional study. *Journal of diabetes research*, 2020. <https://downloads.hindawi.com/journals/jdr/2020/4106383.pdf>.
18. Azmi N, Aris M, Nasreen H, Che-Ahmad A. (2020). Diabetic foot care practice and its associated factors among type 2 diabetes mellitus patients attending Primary Health Clinics in Kuantan, Malaysia: a cross-sectional study. *IIUM Med J Malaysia*.; 19(2):13–9.
19. Al-Mohaithef M., Abdelmohsen S., Algameel M., & Abdelwahed A., (2022). Screening for identification of patients at high risk for diabetes-related foot ulcers: a cross-sectional study. *Journal of International Medical Research* 50(3) 1–11. DOI: 10.1177/03000605221087815.
20. Amini, M.R., Sanjari, M., & Mohajeri Tehrani, M.R. (2023). Evaluation of foot self-care status and foot screening problems in patients with diabetes in Iran: a national multicenter study. *BMC Endocr Disord* 23, 178 (2023). <https://doi.org/10.1186/s12902-023-01401-7>.

21. Seid, A., & Tsige, Y. (2015). Knowledge, practice, and barriers of foot care among diabetic patients attending Felege Hiwot Referral Hospital, Bahir Dar. Northwest Ethiopia. *Adv Nurs.*, 1–9. <https://doi.org/10.1155/2015/93462325>.
22. Abu-elenin MM, Elshoura AA, & Alghazaly GM. (2018). Knowledge, practice, and barriers of foot self-care among diabetic patients at Tanta University Hospitals. *Egypt Egypt J Community Med.* 2018; 36(4):94–102.
23. Alsaleh FM, AlBassam KS, Alsairafi ZK. & Naser AY. (2021). Knowledge and practice of foot self-care among patients with diabetes attending primary healthcare centers in Kuwait: A cross-sectional study. *Saudi Pharm J.*; 29(6):506–15.
24. Galal Y. Khairy W. Taha A., & Amin T. (2021). Predictors of Foot Ulcers among Diabetic Patients at a Tertiary Care Center, Egypt. *Risk Management and Healthcare Policy*: 14 3817–3827.
25. Elhgry GH., Shaala SH. & Albatahgy A. (2023). Patterns and Risk Factors of Diabetic Foot Ulcers among Elderly with Diabetes. *International Egyptian Journal of Nursing Sciences and Research (IEJNSR)* Vol. 3 (2), pp: 13-32.
26. Chang CH, Peng YS, Chang CC, & Chen MY. (2013): Useful screening tools for preventing foot problems of diabetics in rural areas: a cross-sectional study. *BMC Public Health.* Jun 27; 13:612. doi: 10.1186/1471-2458-13-612. PMID: 23802741; PMCID: PMC3848866.
27. Salama, A. A., & Zorin, S. K. (2018). Risk factors of diabetic foot in type 2 diabetic patients, Menoufia University Hospital, Egypt. *Egypt J Comm Med*, 36(1), 87-98.
28. Yimam, A., Hailu, A., Murugan, R., & Gebretensaye, T. (2021): Prevalence of diabetic foot ulcer and associated factors among diabetic patient in Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia. *International Journal of Africa Nursing Sciences*, 14, 100285. <https://www.sciencedirect.com/science/article/pii/S2214139121000081>
29. Dinh TH. and Veves A. (2015). The influence of gender as a risk factor in diabetic foot ulceration. *a Compendium of Clinical Research and Practice* 20(5):127-31.
30. Fawzy, M. S., Alshammari, M. A., Alruwaili, A. A., Alanazi, R. T., Alharbi, J. A., Almasoud, A. M. R., & Toraih, E. A. (2019): Factors associated with diabetic foot among type 2 diabetes in Northern area of Saudi Arabia: a descriptive study. *BMC research notes*, 12(1), 1-7. <https://bmcresearchnotes.biomedcentral.com/articles/10.1186/s13104-019-4088-4>.
31. Tolossa, T., Mengist, B., Mulisa, D., Fetensa, G., Turi, E., & Abajobir, A. (2020): Prevalence and associated factors of foot ulcer among diabetic patients in Ethiopia: a systematic review and meta-analysis. *BMC Public Health*, 20(1), 1-14.
32. Clair C, Cohen MJ, Eichler F, Selby KJ, & Rigotti NA (2015): The effect of cigarette smoking on diabetic peripheral neuropathy: a systematic review and meta-analysis. *J Gen Intern Med*; 30:1193–1203.
33. Bekele F., Berhanu D., Sefera B., & Babu Y., (2022). Diabetic foot self-care practices and its predictors among chronic diabetic mellitus patients of southwestern Ethiopia hospitals: A cross sectional study *International Journal of Africa Nursing Sciences* 17:100489.
34. El-Sedawy D. and Behairy S. (2016). Impact of Preventive Diabetic Foot Nursing Intervention on Foot Status among Patients with Diabetes (2016) *Journal of Health, Medicine and Nursing.* Vol.25.

35. Pourkazemi, A., Ghanbari, A., Khojamli, M., Balo, H., Hemmati, H., & Zetal, J. (2020). In Diabetic Foot Care: Knowledge and Practice. *BMC Endocrine Disorders* 20:40. <https://doi.org/10.1186/s12902-020-0512-y>.
36. Mustafa, A., Iqbal, M., & Parvez, M. A. (2017). Assessment of Knowledge, Attitude and Practices of Diabetics Regarding Their Foot Care. *APMC*, 11(1), 43–47.
37. Tuha, A., Faris, A. G., Andualem, A., & Mohammed, S. A. (2021). Knowledge and practice on diabetic foot self-care and associated factors among diabetic patients at dessie referral hospital. Northeast Ethiopia: Mixed Method. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy*. 14(1203).
38. Muhammad-Lutfi AR, Zaraiyah MR, & Anuar-Ramdhan IM.(2014) Knowledge and practice of diabetic foot care in an in- patient setting at a tertiary medical center. *Malays Orthop J* 2014; 8:22-6.
39. Formosa, C., & Vella, L. (2012). Influence of diabetes-related knowledge on foot ulceration. *Journal of Diabetes Nursing*, 16(3), 111-115.
40. Pereira MG., Pedras S., & Ferreira G. (2019) Self-reported adherence to foot care in type 2 diabetes patients: do illness representations and distress matter? *Primary Health Care Research & Development* 20(e40): 1–8. doi: 10.1017/S1463423618000531.
41. Mousavi Z., Forghan F, Neda Valizadeh N., & Gozashti H., et al. (2023). Evaluation of foot self-care status and foot screening problems in patients with diabetes in Iran: a national multicenter study. *BMC Endocrine Disorders*. 23:178. <https://doi.org/10.1186/s12902-023-01401-7>.
42. Deribe B, Woldemichael K, & Namera G. (2014). Prevalence and factors influencing diabetic foot ulcer among diabetic patients attending Arbaminch Hospital, South Ethiopia. *J Diabetes Metab*; 5(1):1-7. doi:10.4172/2155-6156.1000322.
43. Banik PC, Barua L, & Moniruzzaman M. (2020). Risk of diabetic foot ulcer and its associated factors among Bangladeshi subjects: a multicentric cross-sectional study. *BMJ Open*; 10:e034058. doi:10.1136/ bmjopen-2019-034058.