Original Article

Prevalence and Associated Factors of Diabetic Foot Ulcer Among Adult Diabetic Patients Attended at Madina Hospital in Mogadishu Somalia

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ABSTRACT

Objectives

Diabetes mellitus (DM) is one of the major chronic non-communicable diseases affecting millions of people worldwide. Diabetic foot ulcers(DFUs) are one of the most important complications of chronic diabetes especially in the elderly population. The aim of this study was to determine the prevalence and associated factors of DFU in adult diabetic patients admitted to Madina Hospital in Mogadishu, Somalia.

Materials and Methods

The study design was a hospital-based cross-sectional study. Patients admitted to Mogadishu Madina hospital between December 2021 and April 2022 were evaluated. Quantitative data on the prevalence and associated factors of diabetic foot ulcer among adult diabetic patients were used.

Results

Out of a total of 176 participants, 173 were interviewed, with a response rate of 98.30%. Of the 173 patients, 90 were female (52.02%) and 83 were male (47.98%). Diabetic foot ulcer was detected in 31 of these patients (17.92%). The disease was most common in the 51-60 age group (57.23%). The frequency of DFUs in patients with hypertension was 21/53 (39.62%), and the frequency of diabetic foot ulcers in those who could not control their blood sugar was 29/87 (33.33%). It was observed that 157 (90.75%) of the patients had no diet control and only 16 (3.47%) of them controlled their diets. According to the level of education, DFUs was most common in secondary school level 14 (29.17%).

Conclusion

DFU is one of the most serious life-threatening consequences of diabetes mellitus. In our study group, the disease was most common in the age range of 51-60 years. Vascular and neurologic changes caused by diabetes mellitus predispose to the development of DFU. Gender difference is not significant in terms of developing the disease. Long disease duration and the presence of hypertension are factors contributing to the development of DFU.

Keywords

Diabetes mellitus; complication; diabetic foot ulcer

INTRODUCTION

Diabetes mellitus (DM) is a noncommunicable chronic illness that affects millions of people worldwide. In the twenty-first century, it is a serious public health concern that needs special attention and public health initiatives [1]. As people become older, chronic noncommunicable illnesses such type 2 diabetes, hypertension, stroke, and coronary heart disease become increasingly frequent.

The aging trend in the world population is in the direction of increase due to the increase in life expectancy in societies, decrease in

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fertility rates and improvement in health services. The ageing population is an undeniable global reality and the number of elderly people is increasing faster in developing countries than in developed countries [2]. Type 2 diabetes is also becoming increasingly prevalent worldwide, with approximately 80 per cent of this patient group living in low- and middle-income countries.. Population-based studies have revealed an increase in the prevalence of type 2 diabetes among young people worldwide. With this increase, diabetes-related microvascular and macrovascular problems will become more common [3].

One of the most dangerous issues brought on by uncontrolled, long-term diabetes, particularly in the elderly, is diabetic foot ulcers (DFUs).Diabetes-related foot ulcers affect patients' physical, emotional, social and economic parameters and quality of life [4]. Uncontrolled hyperglycemia, long-term diabetes, trauma, improper footwear, callus, prior ulcer/amputation history, advanced age, blindness/visual impairment, chronic renal disease, and ma lnutrition have all been linked to the development and progression of DFUs. Infections aggravate the diabetic foot, resulting in a persistent non-healing lesion. Today, the treatment of DFUs remains a huge burden on the healthcare system. New techniques are required to effectively and cost-effectively alleviate the burden of care caused by these issues [5].

Due to the complexity of diabetes and its related vascular and neuropathic consequences, DFUs may also be susceptible to both common and uncommon infectious or non-infectious processes [6]. Diabetic foot ulcers are widely recognized as the most costly and dangerous consequence of diabetes, as they are difficult to cure and frequently end in non-traumatic amputations. This is the major cause of lower extremity amputation, resulting in severe morbidity, decreased quality of life, high treatment costs, and huge financial losses [7].

In this study, we aimed to determine the prevalence of DFU and factors associated with the disease in adult diabetic patients admitted to Madina Hospital, Mogadishu, Somalia.

MATERIALS AND METHODS

The study was conducted at Madina Hospital in Wadajir District in Mogadishu, Somalia. The study was designed as a hospital-based cross-sectional study. The study population was all diabetic patients admitted to Madina Hospital. In this context, diabetic patients admitted to Mogadishu Madina hospital from December 2021 to April 2022 were evaluated. Patients who agreed to participate in the study with information were included in the study, and those who did not accept were excluded. The study used quantitative data on the prevalence and associated factors of diabetic foot ulcer among adult diabetic patients.

DATA COLLECTION

Quantitative data collection technique was used to determine the prevalence of DFU in Mogadishu, Somalia. Quantitative data were obtained using structured questionnaire pre tested through guided questionnaire written in English language but facilitated/ translated into Somali language during the interview to obtain information on socio-demographic factors and health related factors associated with diabetic foot ulcer in Somali Mogadishu.

DATA ANALYSIS

The questionnaires was collected through KOBO data collector and checked for their completeness before entry. The analysis was done by using STATA version 15.

ETHICAL CLEARANCE

Ethical Review Approval was obtained from the Ethics and Research Committee of Benadir University (152/23). Also Permission asked from the administration of the health facilities during data collection each participant will inform about the aim of the study. Verbal Informed Consent obtained prior to each interview for every respondent/caregiver in order to participate in the study. The researcher will kept the privacy and confidentiality of the respondents from the public, the undisclosed information stayed confidential; use it only for academic purpose.

RESULTS

The study comprised 176 patients, 173 of whom were interviewed, and three patients who were unable to engage in the interview were omitted from the study. Females were 90(52.02%) and males were 83(47.98%). The highest number of patients was 99 (57.23%) in the 51-60 age group. Other sociodemographic characteristics of the patient group are shown in Table 1. In study group were 12 (6.94%) type 1 DM patients and 161 (93.06%) type 2 DM patients. Diabetes mellitus onset times of the patients are shown in Table 2.

The prevalence of diabetic foot ulcers was 31(17.92%) patients 142(82.08%) patients did not develop DFUs. In the study, 53 patients (30.64%) had a history of hypertension and 120 patients (69.36%) did not. Most of the patients, 140 (80.92%) had no history of hyperlipidaemia. Most of the patients 165 (95.58%) were non-smokers, only 8 (4.62%) were smokers. Among the patients in the study group, 87 (50.29%) did not use anti-diabetic agents and 86 (49.71%) used anti-diabetic agents. Among the patients who received treatment, 73 (84.88%) stated that they used oral anti-diabetic agents and 13 patients (15.12%) stated that they used insulin.

Most of the patients, 167 (96.53%) stated that they did not do physical exercise, only 6 (3.47%) stated that they did physical exercise. It was seen that 157 (90,75%) of the patients did not control their diet and only 16 (3,47%) of them controlled their diet. In Body Mass Index (BMI) evaluation, 80 patients (46.24%) were underweight, 79 patients (45.66%) were normal (18.5-24.9) and only 3 patients (1.73%) were overweight (25-29.9). There were no obese and extremely obese patients in the patient group. In terms of sociodemographic characteristics, DFU was found in 17 (18.88%) female and 14 (16.87%) male patients. Sociodemographic characteristics of patients with diabetic foot ulcer are shown in Table 3.

Health-related factors were evaluated. It was observed that diabetic foot ulcers were 30 (18.63%) more common in type 2 DM and 1 (8.33%) more common in type 1 DM. Health-related factors in patients with diabetic foot ulcers are shown in Table 4. In the lifestyle characteristics, While DFU was mostly absent in those who were currently taking diabetic medication, diabetic foot ulcers were seen in 2 (2.33%) and 29 (33.33%) patients who were not taking diabetic medication. Data on lifestyle factors in diabetic foot ulcer are shown in Table 5.

DISCUSSION

A significant diabetes complication that can result in profound tissue loss in the lower extremities, infection, or ulceration is diabetic foot ulceration (DFU). An estimated 26 million people globally are estimated to be impacted by the illness annually [8]. Male gender, more than ten years of diabetes, old age, and a high body mass index (BMI) are risk factors for the disease's onset. In our study group, the disease was most common in the age range of 51-60 years. There was no significant gender difference in the development of the disease.

Comorbidities such as high hemoglobin A1C, diabetic peripheral neuropathy, peripheral vascular disease, foot deformity, high plantar pressure, poor foot self-care practices, and infections all enhance the risk of DFU development 9. Several studies have found a relationship between blood glucose levels and the occurrence and development of several diabetes problems. Peripheral neuropathy, microangiopathy, microcirculatory abnormalities, decreased leucocyte phagocytosis, and glycosylation of tissue proteins are among the consequences. These diseases can result in delayed wound healing and DFU formation[10].

DFU can be ischaemic, neuropathic or neuro-ischaemic[11], and micro- and macro-vascular disorders play a role in ulcer development [12]. Peripheral neuropathy is caused by infection of the blood vessels supplying blood to the nerves in the lower limbs and results in burning or numbness in the feet with resulting pain and reduced sensory awareness and damage that may not be diagnosed early [13]. In order to detect elements that negatively impact healing and to ascertain the origins of the ulcer, the first examination of DFU should be conducted thoroughly and methodically. Determining the state of vascular perfusion, infection, and neuropathy are crucial in this situation. Noninvasive arterial evaluation using Doppler ultrasonography or angiographic tests can be carried out in addition to inspection in a full vascular evaluation. [14]. Approximately half of DFU patients had atherosclerotic peripheral artery disease (PAD). PAD caused by atherosclerosis affects almost half of DFU patients. PAD is a barrier to wound healing. Since non-healing DFUs are linked to risks of infection, major limb amputation, cardiovascular morbidity and overall mortality, early diagnosis of PAD is crucial for the treatment of DFU disease[15]. In our study, we observed that vascular and neurologic damage caused by long-term diabetes is effective in the development of DFU.

In a study evaluating the efficacy of mini-invasive revascularisation of lower extremity peripheral arteries in neuro-ischemic and ischaemic DFU patients, it was observed that swelling in the foot wound area disappeared faster, granulation appearance and wound epithelialisation occurred earlier than in the control group [16]. Unperceived trauma along with peripheral sensory neuropathy is a component that contributes to DFUs. Approximately 45% to 60% of all diabetic ulcers are purely neuropathic, whereas the other 45% include both neuropathic and ischemic components. Sensory neuropathy was found as the most prevalent component contributing to ulceration in

diabetes individuals in a prospective multicenter study[17]. Diabetic foot ulceration can also begin with calluses, blisters, scrapes, burns, and ingrown toenails that go unnoticed owing to peripheral neuropathy, hence frequent foot examinations are an important element of DFU management[18]. DFUs can also be caused by mechanical changes in the bone structure of the foot [19].

It is well recognized that polymicrobial infections are common in diabetic foot infections, and that infections in diabetic patients are more common and progress more severely than in non-diabetic individuals [20]. Uncontrolled hyperglycemia can make it more difficult for the host's leukocytes to combat bacterial infections, and ischemia can make it more difficult for antibiotics to reach the infection site, aggravating the problem and causing the infection to spread swiftly and permanently [21].

DFU Diabetic foot infection can result in not only lengthy hospitalization but also foot amputations, which increase mortality [22]. Footwear should be examined in people with foot ulcers. Ischaemic and neuro-ischaemic ulcers often develop on the lateral borders of the foot, at the points of the toes, or above the bony deformities, whereas neuropathic ulcers typically begin on the plantar surface of the foot [23]. In a study, it was determined that individuals who had diabetes for more than ten years and who were informed by a physician or nurse about their disease, foot health and care had better foot care behaviours[24].

Restricted joint mobility has also been recognized as a possible risk factor for ulceration in diabetes individuals. Ligaments and capsular structures may stiffen as a result of long-term diabetes-related collagen glycosylation. It has been shown that decreased mobility of the ankle, subtalar, and first metatarso-phalangeal (MTP) joints causes high focal plantar pressures, which raise the risk of ulceration in individuals with neuropathy [25].

The therapy of DFUs is based on surgical debridement. Necrotic tissue should be excised until it comes into touch with healthy, bleeding soft tissue and bone. Remove any callus tissue that has grown around the ulcer as well. Surgical debridement aims to convert a chronic ulcer into an acute, healing wound [26]. Debridement, on the other hand, may be harmful in the case of arterial ulcers [27].

Bacterial growth is facilitated by weakened tissue or closed wound areas. Debridement serves several functions, including the removal of necrotic tissue and callus, the reduction of pressure, the examination of the wound bed, the evaluation of tracking and tunneling, and the reduction of bacterial load, which promotes healing and facilitates drainage. Debridement must be completed before administering topical wound healing medications, dressings, or wound closure procedures to the wound. Only surgical debridement has been shown to be effective in clinical studies out of the five types of debridement presently in use (surgical, enzymatic, enzymatic, autolytic, mechanical, and biological) [27] . In a recent randomised, double-blind and placebo-controlled study, the effect of bitter melon leaf extract on dfu was investigated, but no positive results were obtained in a 4-week study [28].

Due to the possibility of lifelong impairment, diabetic foot ulcers (DFUs) lower patients' quality of life (QOL). Compared to people without ulcers, patients with mobility issues, poor psychosocial adjustment, and a weaker assessment of their health. The weakened tissue repair mechanism, impaired immunity, and malformed foot architecture all contribute to the worsening of the wound. A common reason for amputations, infection exacerbates the wound and slows down its healing process. Compared to diabetic individuals without foot ulcers, people with DFUs had a lower survival rate [29].

CONCLUSION

In conclusion, DFU is one of the most serious life-threatening consequences of diabetes mellitus. In our study group, the disease was most common in the age range of 51-60 years. Vascular and neurologic changes caused by diabetes mellitus predispose to the development of DFU. There was no significant gender difference in the development of the disease. Long disease duration and the presence of hypertension were considered as factors contributing to the development of DFU.

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AUTHORS' CONTRIBUTION

Data gathering and idea owner of this study: MNM, MYH, AOF

Study design: MNM, MSO, OA

Data gathering: MNM, MSO

Writing and submitting the manuscript: MNM, MSO

Editing and approval of final draft: MNM, MYH, AOF, OA

Table 1: Socio- demographic characteristics.

Variable	Category	Frequency	Percent (%)
Gender	Female	90	52.02
	Male	83	47.98
Age group (year)	30-40	7	4.05
	41-50	32	18.50
	51-60	99	57.23
	Above 60	35	20.23
Marital status	Single	0	0
	Married	122	70.52
	Divorced	8	4.62
	Widowed	43	24.86
Educational level	Illiterate	82	47.40
	Primary	34	19.65
	Secondary	48	27.75
	University	9	5.20
Place of residence	Urban	119	68.79
	Rural	54	31.21
Occupation	Employed	64	36.99
	Un-Employed	109	63.01
Income level	Low	89	51.45
	Middle	73	42.20
	High	11	6.36

Table 2: Duration of the diabetes.

Duration of the DM	Frequency	Percentage
1-5 year	80	46.24
>5-10 year	59	34.1
>10-15 year	3	1.73
>15 year	31	17.92
Total	**173**	**100**

DM=Diabetes mellitus

Table 3: Socio- demographic characteristics among diabetic foot ulcer.

Variable	Category	Prevalence of DFU		Total
		Yes	No	
Gender	Female	17	73	90
	Male	14	69	83
Age group (year)	30-40	1	6	7
	41-50	4	28	32
	51-60	22	77	99
	Above 60	4	31	35
Marital status	Single	0	0	0
	Married	30	92	122
	Divorced	0	8	8
	Widowed	1	42	43
Educational level	Illiterate	7	75	82
	Primary	9	25	34
	Secondary	14	34	48
	University	1	8	9
Place of residence	Urban	26	93	119
	Rural	5	49	54
Occupation	Employed	14	50	64
	Un-Employed	17	92	109
Income level	Low	9	80	89
	Middle	19	54	73
	High	3	8	11

DFU=Diabetic foot ulcer

Table 4: Health related factors among diabetic foot ulcer.

Variable	Category	Prevalence of DFU		Total
		Yes	No	
Type of the DM	Type one DM	1	11	12
	Type two DM	30	131	161
Duration of the DM (year)	1 – 5 years	4	76	80
	>5 – 10	7	52	59
	>10 – 15	1	2	3
	>15	19	12	31
History of HTN	Yes	21	32	53
	No	10	110	120

Variable	Category	Prevalence of DFU		Total
		Yes	No	
History of Hyperlipidemia	Yes	16	17	33
	No	15	125	140
Glycemic control	Yes	2	84	86
	No	29	58	87

DM=diabetes mellitus HTN=hypertension DFU= diabetic foot ulcer

Table 5: Lifestyle factors among diabetic foot ulcer.

Variable	Category	Prevalence of DFU		Total
		Yes	No	
Using of anti-diabetic agents currently	Yes	2	84	86
	No	29	58	87
Type of anti-diabetic agents	Oral anti-diabetic agents	27	44	73
	Insulin	4	11	13
Physical exercise	Yes	1	5	6
	No	30	137	167
Diet control	Yes	1	15	16
	No	30	127	157
BMI of the patient	Underweight (<18.5)	22	58	80
	Normal (18.5-24.9)	8	71	79
	Overweight (25-29.9)	1	2	3
	Obese (30-34.9)	0	0	0
	Extremely obese (>35)	0	0	0
Smoking	Yes	1	7	8
	No	30	135	165

BMI=Body mass index

REFERENCES

1. Al-Lawati JA. Diabetes Mellitus: A Local and Global Public Health Emergency! *Oman Med J*. 2017;**32**(3):177-179. doi:10.5001/omj.2017.34
2. Balakumar P, Maung-U K, Jagadeesh G. Prevalence and prevention of cardiovascular disease and diabetes mellitus. *Pharmacol Res*. 2016;113(Pt A):600-609. doi:10.1016/j.phrs.2016.09.040
3. Lin X, Xu Y, Pan X, Xu J, Ding Y, Sun X, Song X, Ren Y, Shan PF. Global, regional, and national burden and trend of diabetes in 195 countries and territories: an analysis from 1990 to 2025. *Sci Rep*. 2020;**10**(1):14790. doi: 10.1038/s41598-020-71908-9
4. García-Morales E, Lázaro-Martínez JL, Martínez-Hernández D, Aragón-Sánchez J, Beneit-Montesinos JV, González-Jurado MA. Impact of diabetic foot related complications on the Health Related Quality of Life (HRQol) of patients--a regional study in Spain. *Int J Low Extrem Wounds*. 2011 Mar;**10**(1):6-11. https://doi.org/10.1177/1534734611400257
5. Alavi, A., Sibbald, R. G., Mayer, D., Goodman, L., Botros, M., Armstrong, D. G., Woo, K., Boeni, T., Ayello, E. A., & Kirsner, R. S. Diabetic foot ulcers: Part II. Management. *Journal of the American Academy of Dermatology*, 2014;**70**(1):21.e1–46. https://doi.org/10.1016/j.jaad.2013.07.048
6. Saeed K, Esposito S, Akram A, Ascione T, Bal AM, Bassetti M, Carnelutti A, Chan M, Davis J, Dryden M, Farhan MFM, Fernando S, Gottlieb T, Gould I, Yildiz M, Lye DC, Pagliano P, Poole S, Pottinger PS, Spera AM, Unal S, Yalcin AN. International Society of Antimicrobial Chemotherapy. Hot topics in diabetic foot infection. *Int J Antimicrob Agents*. 2020 ;**55**(6):105942. doi: 10.1016/j.ijantimicag.2020.105942.
7. Baird J, Jacob C, Barker M, Fall CH, Hanson M, Harvey NC, Inskip HM, Kumaran K, Cooper C. Developmental Origins of Health and Disease: A Lifecourse Approach to the Prevention of Non-Communicable Diseases. *Healthcare (Basel)*. 2017 Mar 8;**5**(1):14. https://doi.org/10.1186/1756-0500-3-254
8. Bakhotmah, Balkees A., and Hasan A. Alzahrani. "Self-reported use of complementary and alternative medicine (CAM) products in topical treatment of diabetic foot disorders by diabetic patients in Jeddah, Western Saudi Arabia." *BMC Research Notes* 3.1 (2010): 1-8. https://doi.org/10.1186/1756-0500-3-254
9. Khan Y, M. Khan M, Raza Farooqui M. Diabetic foot ulcers: a review of current management. *Int J Res Med Sci [Internet]*. 2017;27;**5**(11):4683-9. https://doi.org/10.18203/2320-6012.ijrms20174916
10. Hong O, Buss J, Thomas E. Type 2 diabetes and hearing loss. *Dis Mon*. 2013; **59**(4):139-46. http://dx.doi.org/10.1016/j.disamonth.2013.01.004
11. Turns M. Diabetic foot ulcer management: the podiatrist's perspective. *Br J Community Nurs.* 2013;Suppl:S14-S19. doi:10.12968/bjcn.2013.18.sup12.s14
12. Rangel ÉB, Rodrigues CO, de Sá JR. Micro- and

Macrovascular Complications in Diabetes Mellitus: Preclinical and Clinical Studies. *J Diabetes Res*. 2019: **17**;2019:2161085. doi: 10.1155/2019/2161085.

13. Hicks CW, Selvin E. Epidemiology of Peripheral Neuropathy and Lower Extremity Disease in Diabetes. *Curr Diab Rep*. 2019;**19**(10):86. doi:10.1007/s11892-019-1212-8
14. Lazzarini PA, Crews RT, van Netten JJ, *et al.* Measuring Plantar Tissue Stress in People With Diabetic Peripheral Neuropathy: A Critical Concept in Diabetic Foot Management. *J Diabetes Sci Technol*. 2019;**13**(5):869-880. https://doi.org/10.1177/1932296819849092
15. Mills JL Sr, Conte MS, Armstrong DG, Pomposelli FB, Schanzer A, Sidawy AN, Andros G; Society for Vascular Surgery Lower Extremity Guidelines Committee. The Society for Vascular Surgery Lower Extremity Threatened Limb Classification System: risk stratification based on wound, ischemia, and foot infection (WIfI). *J Vasc Surg*. 2014 ; **59**(1):220-34.e1-2. doi: 10.1016/j.jvs.2013.08.003.
16. Zhakiyev, B., Jakanov, M., Zhanabaev, B., Koyshibaev, A., Mukanov, S., & Aitbayeva, A. (2021). Mini-invasive revascularization operations in the complex treatment of neuroischemic and ischemic forms of diabetic foot syndrome. *Bangladesh Journal of Medical Science*, **20**(4), 817–825. https://doi.org/10.3329/bjms.v20i4.54140
17. Kavitha KV, Tiwari S, Purandare VB, Khedkar S, Bhosale SS, Unnikrishnan AG. Choice of wound care in diabetic foot ulcer: A practical approach. *World J Diabetes*. 2014;**5**(4):546-556. doi:10.4239/wjd.v5.i4.546
18. Hinchliffe RJ, Forsythe RO, Apelqvist J, *et al.* Guidelines on diagnosis, prognosis, and management of peripheral artery disease in patients with foot ulcers and diabetes (IWGDF 2019 update). *Diabetes Metab Res Rev*. 2020;**36** Suppl 1:e3276. https://doi.org/10.1002/dmrr.3276
19. Mariam TG, Alemayehu A, Tesfaye E, *et al.* Prevalence of Diabetic Foot Ulcer and Associated Factors among Adult Diabetic Patients Who Attend the Diabetic Follow-Up Clinic at the University of Gondar Referral Hospital, North West Ethiopia, 2016: Institutional-Based Cross-Sectional Study. *J Diabetes Res*. 2017;2017:2879249. https://doi.org/10.1155/2017/2879249
20. Kambham N. Postinfectious glomerulonephritis. Adv Anat Pathol. 2012;**19**(5):338-347. https://doi.org/10.1097/pap.0b013e31826663d9
21. Chávez-Reyes J, Escárcega-González CE, Chavira-Suárez E, León-Buitimea A, Vázquez-León P, Morones-Ramírez JR, Villalón CM, Quintanar-Stephano A, Marichal-Cancino BA. Susceptibility for Some Infectious Diseases in Patients With Diabetes: The Key Role of Glycemia. *Front Public Health*. 2021;**9**:559595. doi: 10.3389/fpubh.2021.559595.
22. Schaper NC, Van Netten JJ, Apelqvist J, Lipsky BA, Bakker K; International Working Group on the Diabetic Foot (IWGDF). Prevention and management of foot problems in diabetes: A Summary Guidance for Daily Practice 2015, based on the IWGDF guidance documents. *Diabetes Res Clin Pract*. 2017;**124**:84-92. https://doi.org/10.1016/j.diabres.2016.12.007
23. Schaper NC, van Netten JJ, Apelqvist J, Bus SA, Hinchliffe RJ, Lipsky BA; IWGDF Editorial Board. Practical Guidelines on the prevention and management of diabetic foot disease (IWGDF 2019 update). *Diabetes Metab Res Rev*. 2020;36 Suppl **1**:e3266. https://doi.org/10.1002/dmrr.3266
24. Sert, Havva *et al.* Foot Self-Care Behaviours and the Level of Perceived Risk of Amputation in Type 2 Diabetes. *International Journal of Human and Health Sciences (IJHHS)* 2022 ;**6**(3): p. 280-288. ISSN 2523-692X: doi:http://dx.doi.org/10.31344/ijhhs.v6i3.459.
25. Abate M, Schiavone C, Salini V, Andia I. Management of limited joint mobility in diabetic patients. *Diabetes Metab Syndr Obes*. 2013;**6**:197-207. https://doi.org/10.2147/dmso.s33943
26. Yazdanpanah L, Nasiri M, Adarvishi S. Literature review on the management of diabetic foot ulcer. *World J Diabetes*. 2015;**6**(1):37-53. https://doi.org/10.4239/wjd.v6.i1.37
27. Dayya D, O'Neill O, Habib N, Moore J, Iyer K, Huedo-Medina TB. Debridement of diabetic foot ulcers: public health and clinical implications - a systematic review, meta-analysis, and meta-regression. *BMJ Surg Interv Health Technol*. 2022:**30**;4(1):e000081. doi: 10.1136/bmjsit-2021-000081.
28. Rosyid, F. N., Prasetyo, T. A., Prabawati, C. Y., Supratman, .-., Sugiarto, .-., & HS, K. H. N. (). The Effect of Bitter Melon (Momordica charantia L.) Leaves Extractonon Glycated Albumin in Diabetic Foot Ulcers: Randomized Controlled Trial. *Bangladesh Journal of Medical Science*2021; **20**(2): 281–287. https://doi.org/10.3329/bjms.v20i2.51536
29. Boateng J, Catanzano O. Advanced Therapeutic Dressings for Effective Wound Healing--A Review. *J Pharm Sci*. 2015 ;**104**(11):3653-3680. doi: 10.1002/jps.24610.