p-ISSN: 2548-4079/e-ISSN: 2685-7561

UMI Medical Journal
Volume 10 Issue 2 (December, 2025): 84-91

Original Article **Open Access**

Factors Affecting the Occurrence of Diabetic Ulceration in Patients with Type II Diabetes Mellitus

Reeny Purnamasari[1*], Febie Irsandy Syahruddin[2], Millaty Halifah Dirgahayu[3]

[1]Department Surgery, Faculty of Medicine, Universitas Muslim Indonesia, Makassar, Indonesia
[2]Department of Radiology, Faculty of Medicine, Universitas Muslim Indonesia, Makassar, Indonesia
[3]Department of Physiology, Faculty of Medicine, Universitas Muslim Indonesia, Makassar, Indonesia

*Corresponding Author. E-mail: reenyp@gmail.com

DOI: 10.33096/7s03ww21

ABSTRACT

Background: *Diabetes mellitus (DM) is a condition characterized by high blood glucose levels, which increases the risk of macrovascular and microvascular complications, thereby reducing patients' quality of life. One complication of DM is neuropathy, which is characterized by reduced sensation in the feet and is often associated with foot ulcers. Approximately 50% of the diabetic population is at risk of developing diabetic foot ulcers.*
Objective: *This study aimed to identify factors associated with the occurrence of diabetic foot ulcers in patients with type II diabetes mellitus.*
Methods: *This study used a descriptive-analytic design with a cross-sectional approach.*
Results: *The study found that diabetic foot ulcers in patients with type 2 DM were most prevalent in those over the age of 65 (25 individuals, 75.76%), female (19 individuals, 57.6%), with a normal Body Mass Index (BMI) (24 individuals, 72.73%), having suffered from type 2 DM for more than five years (26 individuals, 78.79%), high HbA1c levels (30 individuals, 90.91%), and regular foot care practices (22 individuals, 66.67%).*
Conclusion: *The most dominant factors associated with diabetic foot ulcers are older age (> 65 years), duration of diabetes of more than five years, high random blood glucose levels, and elevated HbA1c levels.*

Keywords: *Type II diabetes mellitus; diabetic foot ulcer; contributing factors*

Article history:
Received: 7 May 2025
Accepted: 11 October 2025
Published: 22 December 2025

INTRODUCTION

An increase in blood sugar levels, or hyperglycemia, is one of the characteristics of diabetes mellitus (DM). Hyperglycemia occurs when blood glucose levels rise due to abnormalities in insulin secretion, insulin action, or both.[1] Chronic hyperglycemia in diabetes is associated with the risk of long-term damage and dysfunction or failure of several organs, including the eyes, kidneys, nerves, heart, and blood vessels.[2]

DM can be accompanied by complications, both acute and chronic. Acute complications of DM can include Hyperglycemic and hypoglycaemic crises, while chronic complications of DM include macroangiopathy, microangiopathy, and neuropathy.[3] One of the most common chronic complications is diabetic ulceration, which is caused by angiopathy, neuropathy, and infection.[4]

Diabetic foot ulcers are a condition in which infection and tissue damage occur in the skin of the feet of people with diabetes mellitus due to nerve damage (neuropathy) and disruption of the peripheral arteries.[5] This condition is triggered by hyperglycemia, which causes changes in the skin and muscles and affects the distribution of pressure on the soles of the feet, making ulcers more likely to occur. These ulcers tend to be difficult to heal due to reduced nerve function in the lower extremities. Diabetic foot ulcers often occur due to a combination of neuropathy (sensory, motor, autonomic), which is the most common risk factor, and ischemia. The loss of pain sensation directly damages the feet because peripheral nerve damage often develops slowly and is often asymptomatic.[6,7]

The causes of diabetic foot ulcers in people with DM can be attributed to various factors, namely peripheral neuropathy, peripheral arterial disease, foot deformities, foot trauma, and impaired resistance to infection, which are thought to be the main contributing factors.[8] There are also other factors that are thought to cause diabetic foot ulcers, namely 8,13,14, having had diabetes mellitus for more than 5 years, poor blood sugar control, advanced age (over 60 years), obesity, irregular foot care, lack of physical activity, use of inappropriate footwear, lack of knowledge, previous history of ulcerative wounds, male gender, and ethnicity/race.[9,10]

METHODS

The research design used was a descriptive analytical design with a cross-sectional study approach, with the aim of identifying the factors that influence the incidence of diabetic ulcers in patients with diabetes mellitus. The sample in this study consisted of all patients diagnosed with diabetes mellitus with diabetic ulcers, selected using total sampling technique. Independent variables: risk factors.

Dependent variable: diabetic ulcers. Inclusion criteria: Diagnosed with diabetes mellitus with diabetic foot ulcers, complete medical records, willing to participate in the study. Exclusion criteria: Patients diagnosed with diabetes mellitus with diabetic foot ulcers but with a history of or currently suffering from neurological disease. Patients diagnosed with diabetes mellitus with diabetic foot ulcers but with a history of or currently suffering from heart disease or other vascular diseases. The study received approval from the Research Ethics Committee of the Faculty of Medicine, UMI, with number 506/A.1/KEP-UMI/X/2023. Additionally, we also obtained permission from the institution where the study was conducted, in this case, RS Bahagia Makassar.

RESULT

In this study, 33 samples were obtained, with data collection conducted at the Medical Records Department of Bahagia Hospital and Clinic from October 2023 to December 2023.
The following results were obtained from the research sample:

Table 1. Distribution by age (age categories according to WHO and Ministry of Health)

Age (Year)	Amount	(%)
24-45	2	6,06
46-65	6	18,18
>65	25	75,76

From the data we obtained, it is known that the highest number of DMT2 patients with diabetic foot ulcers were found in the > 65 age group, namely 25 people (75.76%), and the lowest number were found in the 24-45 age group, namely 2 people (6.06%).

Table 2. Distribution by gender

Gender	Amount	(%)
Woman	19	57,6
Man	14	42,4

The distribution of DMT2 patients with diabetic foot ulcers based on gender showed that there were more female patients, namely 19 people (57.6%), compared to male patients, namely 14 people (42.4%).

Table 3. Distribution based on body mass index

Body mass Index (BMI)	Amount	(%)
Less (< 18,5)	1	3,03
Normal (18,5 – 22,9)	24	72,73
Overweight (> 23)	8	24,24

According to body mass index (BMI), the distribution of DMT2 patients with diabetic foot ulcers was highest among those with normal BMI, namely 24 people (72.73%), followed by those with higher BMI, namely 8 people (24.24%), and those with lower BMI, namely 1 person (3.03%).

Table 4. Distribution based on duration of diabetes mellitus

Duration of DMT2	Amount	(%)
≤ 5 years	7	21,21
> 5 years	26	78,79

Based on the duration of DMT2, the results show that those who have suffered from DMT2 for less than 10 years are more numerous than those who have suffered from DMT2 for less than 5 years, namely 26 people (78.79%) and 7 people (21.21%).

Table 5. Distribution based on random blood glucose values

Blood Glucose Values (mg/dL)	Amount	(%)
< 200	12	36,36
> 200	21	63,64

Based on the random blood glucose (RBG) values in patients with DMT2 and diabetic foot ulcers, RBG values above 200 mg/dL were more common than RBG values below 200 mg/dL, with 21 patients (63.64%) and 12 patients (36.36%), respectively.

Table 6. Distribution based on HbA1c value

HbA1C	Amount	(%)
High (≥ 6,5)	30	90,91
Borderline (5,7 – 6,4)	2	6,06
Normal (< 5,7)	1	3,03

Based on HbA1c values in patients with DMT2 and diabetic foot ulcers, the highest increase in HbA1c values was found in 30 patients (90.91%), with 2 patients (6.06%) having borderline values and 1 patient (3.03%) having normal values.

Table 7. Distribution according to regularity of foot care

Foot Care	Amount	%
Performed	11	33,33
No Performed	22	66,67

Based on the history of regular foot care, it was found that the highest number of DMT2 patients with diabetic foot ulcers were those who did not perform foot care, namely 22 people (66.67%), compared to those who did perform foot care, namely 11 people (33.33%).

Table 8. Distribution according to regularity of wearing appropriate footwear

Wearing Approriate Footwear	Amount	%
Regullar	17	51,52
Irreguler	16	48,48

Based on the regularity of wearing appropriate footwear, it was found that DMT2 patients with diabetic foot ulcers were slightly more prevalent among those who wore appropriate footwear regularly, namely 17 people (51.52%), compared to those who did not wear appropriate footwear regularly, namely 16 people (48.48%).

DISCUSSION

Our research aims to identify the factors that influence the occurrence of diabetic ulcers in patients with DMT2. Our research assesses several factors that are theoretically associated with an increased risk of diabetic foot ulcers.[11]

In old age, it is known that bodily functions decline physiologically due to the ageing process. During this process, there is a decrease in insulin secretion or resistance, resulting in the body's inability to optimally control high blood glucose levels.[12] If this condition persists without control, it will trigger hyperglycemia, which can cause neuropathy and oxidative stress, thereby increasing the risk of diabetic foot ulcers. The same findings were reported in a study conducted by Muhdar R.[13]

Theoretically according to Rubeaan K (2015), it is asserted that women are thought to be at greater risk of developing diabetic foot ulcers because fat levels in women tend to be higher than in men.[14]

It is this fat that triggers changes in the body's cellular response to insulin, leading to resistance or a reduction in the level/amount of insulin flowing into the blood, resulting in hyperglycemia.[15] If left uncontrolled, this can cause neuropathy and oxidative stress before diabetic foot ulcers develop. The research conducted by Muhdar in 2018 yielded the same results, but Santanelli F and Najami U in 2015 produced opposite results.[13,16]

In theory, obesity is considered a risk factor that needs to be watched out for because it is suspected that being overweight leads to excessive calorie intake, which can cause beta cells in the pancreas to become unable to produce enough insulin to compensate for the excess calories.[17] This ultimately leads to increased blood glucose levels, triggering neuropathy and oxidative stress, which can lead to diabetic foot ulcers.[18] La Gau in 2019 had the highest BMI, which is classified as obese, with a risk of diabetic foot ulcers. This is not in line with the research we obtained, and it is possible that this occurred because there were other factors involved.[18,19]

Based on theory that the longer a person suffers from DMT2, the longer they are exposed to hyperglycemia and the greater the risk of developing chronic hyperglycemia. This chronic hyperglycemia will cause hyperglycemia, a condition in which cells are flooded with glucose.[20] Chronic hyperglycemia alters the biochemical homeostasis of these cells, which in turn has the potential to cause fundamental changes in the development of chronic diabetes mellitus complications. Rubeaan AK et al., Santanelli F and Najami U et al. in 2015 obtained similar results. [14,13]

High blood sugar levels can occur due to the patient's lifestyle, such as an unbalanced diet or high sugar intake, not receiving treatment for diabetes, irregular medication, and lack of physical activity.[15] Increased blood sugar levels can also be influenced by the patient's age and stress conditions that may

be experienced by the patient due to their illness. Eltrikanawati, in 2021 Santanelli F, and Hajjeh et al. in 2015 also found the same results.[19,14]

This HbA1c value is influenced by the blood sugar levels of DM patients, because an increase in HbA1c indicates that the blood sugar levels of DM patients are not well controlled. One of the causes is irregular treatment. Siti and Maidiana in 2020 found that the occurrence of diabetic foot ulcers is associated with high HbA1c levels. [21,22]

Irregular foot care can cause minor wounds/trauma to develop into ulcerative wounds. Standard foot care (checking the condition of the feet, maintaining foot hygiene/moisture, and nail care) can reduce the risk of diabetic ulcers. Nestriani NW et al., in 2020 found similar results to our study.[21]

The proper use of footwear will help reduce pressure on the soles of the feet and prevent/protect the feet from trauma. This is important to do regularly, especially for people with diabetes who already have neuropathy, because reduced or lost sensitivity means they are unaware of small wounds that can spread and can be prevented or minimized by wearing footwear. Risman et al. in 2020 found that the use of appropriate footwear is strongly associated with the occurrence of diabetic foot ulcers, but this does not align with our findings.[18,21]

CONCLUSION

Based on our research results, it can be concluded that the distribution of patients with diabetic foot ulcers was highest in those aged > 65 years, namely 25 people (75.76%). The majority were female, namely 19 people (57.6%), with a normal BMI, namely 24 people (72.73%), and had suffered from DM for more than 5 years, namely 26 people (78.79%), where high GDS levels (>200 mg/dL) were present in 21 individuals (63.64%) and high HbA1c levels were present in 30 individuals (90.91%). The distribution of DM patients with diabetic foot ulcers based on the regularity of foot care was most common among those who did not perform regular foot care, totaling 22 individuals (66.67%), and the use of appropriate footwear was either regular (51.52%) or irregular (48.48%).

Conflicts of Interest

The authors declare no conflict of interest.

Funding Sources

-

Aknowledgments

-

REFERENCES

1. DE., Schteingart Hartanto H, Susi N, Wulansari P, Mahanani DA. No Title. Metabolisme Glukosa Dan Diabetes Mellitus 2005;(Jakarta: EGC;).
2. Organization WH. No Title. 2006. Available from: http://www.who.int/Diabetes/Publications/Definition and diagnosis of diabetes_ New.Pdf [Last accessed: 4/14/2017].
3. Indonesia. PE. No Title. Konsensus Pengendalian Dan Pencegahan Diabetes Mellitus Tipe 2 2011.
4. Shaw JE, Sicree RA ZPZ. No Title. Global Estimates Of The Prevalence Of Diabetes For 2010 And 2030 2010;(87): 4-14.
5. Diabetes- ADAssociationSOMCI. No Title. Diabetes Care 2015.
6. Bilous R DR. No Title. Buku Pegangan Diabetes Ed 4 2014;(Jakarta: Bumi Medika;).
7. Kesehatan BPDP. No Title. 2013.
8. OS P. No Title. Analisis Faktor-Faktor Risiko Terjadi Ulkus Kaki Pada Penderita Diabetes Mellitus Di RSUD DR Moewardi 2013;(Depok: Universitas Indonesia;).
9. Roza RL, Afriant R EZ. No Title. Faktor Risiko Terjadinya Ulkus Diabetikum Pada Penderita Diabetes Mellitus Yang Dirawat Jalan Dan Inap Di RSUP Dr M Djamil Dan RSI Ibnu Sina Padang Jurnal Kesehatan Andalas n.d.;4(1):243–248.
10. RW. K. No Title. Pengelolaan Gangren Kaki Diabetik CDK 2017;44(1):18–22.
11. RG F. No Title. Diabetic Foot Disorders A Clinical Practice Guidline The Journal of Foot an Ankle 2006;5(5).
12. P. BJMACHC. The pathways to ulceration: aetiopathogenesis. The Foot in Diabetes 2000;3:19.
13. ME. MRSJK. Hubungan lama Menderita dan Perawatan Kaki Diabetes Dengan Resiko Ulkus Kaki Diabetik di Klinik Husada Sario Manado. Ejournal Keperawatan 2018;6(2).
14. Rubeaan KA. Derwish MA. Ouizi S. Youssef AM et al. Diabetic Foot Complications and Their Risk Factors from A Large Retrospective Cohort Study. PLoS ONE 2015;10(5).
15. Latifah. NNWMAD. Hubungan Perilaku Perawatan Kaki Terhadap KejadiUlkus Kaki Diabetik. Journal of Nursing Invention 2023;4(1).
16. Gunarathne L, Bhowmik J, Apputhurai P, et al. Factors and consequences associated with intimate partner violence against women in low- and middle-income countries: A systematic review. PLoS ONE 2023;18(11 November):1–23; doi: 10.1371/journal.pone.0293295.
17. RW. K. Pengelolaan Gangren Kaki Diabetik. CDK 2017;44(1):18–22.
18. BD. LGauDRHS. Hubungan Indeks Massa Tubuh Dengan Resiko Kaki Diabetik Pada Pasien DMT2 Tipe II di Puskesmas Tuminting Kota Manado. Jurnal Kesehatan: Amanah Prodi Ners Universitas Muhammadiyah Manado 2019;3(2):115–122.
19. T E. Hubungan Kadar Glukosa Darah Dengan Resiko Ulkus Kaki Diabetik Pada Diabetes Mellitus Tipe II. Jurnal Keperawatan Terapan 2021;7(2):150–156.
20. AKC. J. A New Classification Of Diabetic Foot Complications : A Simple And Effective Teaching Tool. The Journal Of Diabetic Foot Complication 2012;4(1):1–5.
21. M RismanSEJ. Hubungan Penggunaan Alas Kaki Dengan Luka Kaki Diabetik di Klinik Perawatan Luka Kota Makassar. Jurnal Ilmiah Kesehatan Diagnosis 2020;15(2):112–116.
22. PERKENI. Pengelolan dan Pencegahan Diabetes Mellitus Tipe 2 di Indonesia. Kaki Diabetes 2021;65–80.