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Risk Factors for Foot Deformities and Diabetic Ulcers Among Diabetes Mellitus Patients in Wound Care Clinic Pontianak

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Abstract

Foot deformities have long been recognized as significant risk factors contributing to the development of foot ulcers in individuals with diabetes mellitus. Diabetic foot complications, particularly diabetic ulcers, are known to cause a substantial decline in the overall quality of life for affected patients. This research contributed to identify and analyze various types of foot deformities observed in diabetes mellitus patients, along with evaluating their potential contribution to the incidence of diabetic ulcers, in Wound Care Clinic Pontianak. This research employed a cross-sectional study design, utilizing a total sampling method. A total of 40 patients who visited the clinic during December 2024 were included in the sample. The data collection instrument consisted of an observational sheet for foot deformities, supported by visual guides featuring representative images. Photos of patients' feet were taken using a cellphone camera, capturing views from anterior, posterior, or lateral angles as necessary. These images were then compared to reference images representing five foot deformities: hallux valgus, hammer toe, claw toe, mallet toe, and Charcot foot. Among the findings, claw toe emerged as the most prevalent deformity, highlighting its significance as a key risk factor in the development of diabetic ulcers.

Keywords: *Diabetes Mellitus; Diabetic Ulcer; Foot Deformity*

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1. Introduction

One of the serious complications that often occur due to diabetes is diabetic ulcers. Diabetic ulcers involve partial or complete damage to the skin, which can extend to the underlying tissue, tendons, muscles, bones, or joints in individuals with diabetes. This condition arises as a result of persistently high blood sugar levels (Wang et al., 2022, Monteiro-Soares et al., 2020). If a diabetic ulcer remains untreated for a prolonged period and fails to heal properly, it can become infected.

Diabetic foot ulcer is a serious complication of diabetes, associated with high mortality, morbidity, and significant medical costs (Moore et al., 2021). Diabetic foot problems can also lead to job loss or reduced income for patients, hinder their education, and damage social relationships. These issues can also indirectly impact their psychological well-being and overall environment. Therefore, risk factors must be identified and monitored to prevent diabetic foot complications (Polikandrioti et al., 2020).

Infected foot ulcers often lead to gangrene and may ultimately result in the amputation of the lower extremities (Dayya et al., 2022). The prevalence of diabetic ulcers is reported to be quite high in various countries. Globally, the prevalence reaches 6.3% (Jodheea-Jutton et al., 2022). One of the risk factors contributing to the development of diabetic ulcers is foot deformity. Foot deformities increase pressure on the foot, and when combined with neuropathy, they further elevate the risk of developing diabetic ulcers (Armstrong et al., 2023, Dewi & Hinchliffe, 2020).

Foot deformities have been identified as a risk factor for foot ulcers in individuals with diabetes. Diabetic foot complications, such as diabetic ulcers, can negatively impact the quality of life of those affected (Polikandrioti et al., 2020). Structural deformities in the feet of diabetic patients are often the underlying cause of diabetic ulcers (Primadhi & Herman, 2021).

Some deformities commonly found in diabetic feet include hallux valgus and hammer toe (Mekonnen et al., 2021). In addition, other

deformities such as claw toes, mallet toes, and Charcot foot are also frequently observed in individuals with diabetes. These deformities can alter foot biomechanics, increase pressure on certain areas, and elevate the risk of foot ulcers (Ababneh et al., 2020, Tsaklis & Tentolouris, 2024)

Several previous studies have examined the risk of diabetic ulcers in patients with type 2 diabetes and have identified foot deformities as one of the contributing factors (Rossboth et al., 2021). This study focuses on patients with foot deformities who have a higher risk of developing diabetic ulcers. However, few studies have provided a detailed explanation of the specific types of foot deformities commonly experienced by patients and their associated risks. In this context, it is important to conduct further research on the types of foot deformities in patients with diabetic ulcers to predict which types of deformities have a higher incidence of ulcers.

2. Method

This study explores the relationship between different types of foot deformities as risk factors and the incidence of diabetic ulcers. It also analyzes the extent to which foot deformities contribute to the risk of ulcers in patients with Diabetes Mellitus. The research design used was cross-sectional, and the sampling technique applied was total sampling, involving 40 patients who visited the diabetes wound care clinic in December 2024.

The instrument used in this study was a foot deformity observation sheet, accompanied by guided images of foot deformities. Data collection was conducted using a cellphone camera to capture images of foot deformities. Images were taken from at least one of three possible angles, anterior view, posterior view, or lateral view, as needed to facilitate interpretation. The captured images were then compared with the reference guide, which included five types of foot deformities: hallux valgus, hammer toe, claw toes, mallet toe, and Charcot foot, each represented by a single reference image to aid in analysis.

The instrument, in the form of a foot deformity guide image, was tested for validity through expert judgment by consulting with specialists experienced in wound care and research related to diabetes mellitus and diabetic ulcers. This consultation was conducted to ensure that the instrument aligned with relevant theories and research objectives, making it suitable for data collection. This research was conducted in January 2025 at the Wound Care Clinic Pontianak.

The collected data will be processed and analyzed. The first stage involves a univariate analysis to understand the overall distribution of foot deformity types. Next, an analysis will be conducted to identify which risk factors associated with different types of foot deformities are linked to the incidence of diabetic ulcers in patients. This research was reviewed and approved by the Ethics Committee of Health Research, STIKes Yarsi Pontianak under ethical permit number: 006/KEPK/STIKes.YSI/I/2025.

3. Results and Discussion

Table 1 shows that the majority of respondents were male (42,5%), with a middle age of 45–59 years and most had suffered from diabetes mellitus for 5–10 years (50%). Previous research suggests that men have a higher risk of developing diabetes than women. A study conducted by scientists from the University of Glasgow, Scotland, involved 51,920 men and 43,137 women, all of whom were type 2 diabetes sufferers with a body mass index (BMI) above the overweight threshold. The study results showed that men developed diabetes at an average BMI of 31.83 kg/m², whereas women developed it at an average BMI of 33.69 kg/m². This difference in risk is attributed to body fat distribution, as men tend to accumulate fat in the abdominal area, increasing the risk of central obesity, which contributes to metabolic disorders (Yosa & Wibowo, 2023). Previous research found different results, indicating that the female gender was associated with the incidence of foot deformities. Reports from previous studies also explained that women experienced a higher incidence of foot deformities compared to men (Lacopi et al., 2023). Women tend to adopt a more modern lifestyle than men, particularly in terms of footwear choices. Women's shoes are often designed with a pointed front, limiting the space available for toe movement.

Based on age characteristics, individuals aged 40–60 years have a high risk of developing diabetes mellitus. This phenomenon may be due to the physiological decline that occurs after the age of 40, contributing to an increased risk of angiopathy. Additionally, in older age, the wound healing process tends to be slower, which may be caused by a decline in blood vessel function and an increased risk of infection (Nanayakkara et al., 2021). In line with the results of other studies, Kossioris et al., (2019) stated that the average age of the total sample was 64.9 years. Their study examined diabetes mellitus patients who experienced foot deformities, whether or not they had undergone amputation. Similarly, the research by Sutkowska et al., (2019) found that the average age of patients in their study was 64.6 years. Also reported that the average age of individuals suffering from diabetic foot deformities was 61 years. According to researchers, the risk of developing deformities increases with age because

individuals have a reduced ability to care for themselves, particularly their feet.

A long history of diabetes mellitus can be a contributing factor to foot deformities. Previous research states that individuals who have had diabetes mellitus for ≥5 years are nearly twice as likely to develop ulcers compared to those with a disease duration of less than 5 years (Rubio et al., 2020). As the disease progresses and microangiopathy develops, diabetic neuropathy can trigger foot ulcers, deformities, and even amputation (Edmonds et al., 2021).

Table 1. Characteristics of research respondents based on gender, age, and suffered from diabetes mellitus (n=40)

Variable	f	%
Gender		
Man	24	60.0%
Women	16	40.0%
Age		
Adult (26-44 years)	7	17.5%
Middle age (45-59 years)	17	42.5%
Elderly age (60-74 years)	16	40.0%
old (75-90 years)	0	0
Very old (>90 years)	0	0
Suffered from diabetes		
<5 years	4	10.0%
5-10 years	20	50.0%
>10 years	16	40.0%

Table 2 shows the distribution of characteristics of the most common type of foot deformity, namely Claw Toe, which was found in 14 respondents (35%). The research result also shown that Claw Toe is the most common type of foot deformity in patients with diabetes mellitus (DM). These findings align with the fact that nerve damage is a major factor in the pathogenesis of diabetic foot deformities, with the most distal extremities, such as the toes, being the first to be affected (Kimura et al., 2020).

In this study, five types of diabetic foot deformities were analyzed, four of which focused on toe deformities, namely hallux valgus, hammer toe, claw toe, and mallet toe. Claw toe deformity was recorded as the most common, with a prevalence of 35% among 40 respondents, while the incidence of diabetic ulcers was 39.4%. This finding is consistent with research conducted by Debattista et al., (2021) which reported that 68% of ulcers occurred on the toes. This observation is highly significant, considering that the toes of diabetic patients undergo various structural changes, primarily due to glycosylation the accumulation of glucose in soft tissues which negatively affects the elasticity of tendons, ligaments, and muscles. As a result of these limitations, toe deformities, particularly claw toe, hammer toe, mallet toe, and hallux valgus, have been shown to have a higher incidence in individuals with ulcers. Furthermore, this deformity, combined with the limited blood supply to the toes due to the small lumen of the digital artery, makes the toes particularly vulnerable to ulceration when subjected to pressure from footwear and/or the deformity itself.

The results of this study showed that the most common type of foot deformity among patients was Hallux valgus. Previous research found that data analysis from 55 respondents showed that 16 respondents had foot deformities. The most common deformity found in patients was Hallux valgus, with a total of 10 cases (Dismore, 2022). Hallux valgus develops due to a deformity of the bones in the big toe joint (first metatarsal). The big toe grows abnormally, tilting towards the other toes. A multiplanar deformity, including a rotational component, has been recognized over the past 5 to 10 years in individuals experiencing it. Pronation of the metatarsal bones has been identified as the cause of the rounded appearance of the metatarsal heads, while supination pressure has been found to be beneficial for achieving better deformity correction (Wagner & Wagner, 2020). Using CT scans, up to 87% of hallux valgus cases show pronation of the metatarsal bones, highlighting the multiplanar nature of the deformity. This pronation explains the observed shape of the metatarsal bones and the medial malposition of the sesamoid bones in radiological studies, which has been identified as one of the most significant factors contributing to recurrence after treatment (Najefi et al., 2022).

Table 2. Frequency distribution of foot deformity types experienced by diabetes mellitus patients (n=40)

Variable	f	%
Foot deformity types		
Hallux valgus	9	22.5%
Hammer toes	8	20.0%
Claw toe	14	35.0%
Mallet toe	7	17.5%
Charcot Foot	2	5.0%

Another type of foot deformity examined in this study was Charcot foot, which was identified in one respondent, accounting for 5% of the total patients who experienced ulcers. The low number of Charcot foot cases in this study can be attributed to the limited number of respondents and the relatively low prevalence of this deformity. In a study conducted by Edmonds et al., (2021), it was reported that among patients with diabetes, there was one case of Charcot neuroarthropathy for every

680 individuals. Further analysis revealed one case for every 333 individuals with diabetes.

Table 3 shows the previous history of ulcers. More than half of the respondents in this study (57.5%) had a history of previous ulcers. This finding aligns with research conducted by Ouyang et al, (2021) which demonstrated a relationship between a history of previous ulcers and the incidence of diabetic foot ulcers. Similarly, research by Badahdah et al., (2024) reported that 49.1% of the 57 respondents suffered from recurrent diabetic foot ulcers.

Furthermore, research found that diabetes mellitus patients with a history of previous ulcers have a 3.25 times greater risk of experiencing chronic complications in their feet. This may be due to a lack of awareness among diabetes patients regarding ulcer prevention, which is often exacerbated by smoking habits, further deteriorating their health condition.

A history of ulcers or previous amputations is not the sole factor contributing to ulcer development (Gong et al., 2023). If an individual sustains an injury while experiencing uncontrolled blood sugar levels, microorganisms can easily invade and persist for an extended period. This condition arises due to high glucose levels, which create an ideal environment for microbial growth, compounded by a weakened immune system, thereby increasing the risk of infection (Arora et al., 2021).

Table 3. Frequency distribution previous history of ulcers (n=40)

Variable	f	%
Previous history of ulcers		
Having history	23	57.5%
No history	17	42.5%

In this study, patients with good knowledge of diabetes mellitus had fewer diabetic wounds and foot deformities. Despite the fact that most respondents had a high level of education, they were also proactive in seeking information and learning about the disease they suffered from. As a result, they paid close attention to reliable sources of knowledge regarding diet management, physical activity, consulting healthcare services, taking medication regularly, and performing proper foot care. Most respondents understood the importance of foot care and maintenance, as they had received extensive information about the high risk of foot deformities in diabetes mellitus (DM) patients. They were also aware that these deformities could lead to complications such as ulcers and, in severe cases, even amputation. Previous research has explained that diabetic foot conditions pose a significant physical and mental burden on patients. However, these complications can be prevented through proper patient education, regular preventive care, and appropriate treatment (Bus et al., 2020).

Table 4 shows that the majority of respondents experienced diabetic ulcers, with a total of 34 respondents (85%). This finding is consistent with research by Chang et al., (2020) which reported that most diabetes mellitus patients suffer from diabetic ulcers. Similarly, research Bekele et al., (2020) revealed that diabetic ulcers are the most common complication among diabetes mellitus patients. According to Theocharidis & Veves, (2020) a diabetic ulcer is a wound on the feet of diabetic patients caused by peripheral and autonomic nerve disorders. Several factors increase the risk of diabetic ulcers in individuals with diabetes, including sensory neuropathy, which makes patients unaware of wounds on their feet; ischemic disorders, which slow down the wound healing process; and immune system disorders (Manisha et al., 2024)

The prevalence of diabetic ulcers is recorded at 15%, with the risk of amputation reaching approximately 30% and a mortality rate of around 32%. In Indonesia, diabetic ulcers are the leading cause of hospitalization, accounting for up to 80% of hospital admissions. Approximately 13% of diabetic foot wounds occur in hospitalized diabetes patients, while around 26% of diabetes patients receive outpatient care (Hidayat et al., 2022).

Table 4. Frequency distribution Incidence of Diabetic Ulcers in Patients with Diabetes Mellitus (n=40)

Variable	f	%
Incidence of Diabetic		
Having an ulcers	34	85.0%
No ulcers	6	15.0%

The findings of this study indicate a weak correlation between risk factors and the incidence of foot deformities and diabetic ulcers among patients with diabetes mellitus. This weak correlation may be attributed to several factors, such as the limited variation in respondents' characteristics, relatively good patient awareness regarding foot care, and the possible presence of unmeasured confounding variables, including long term blood glucose control, duration of diabetes, or adherence to therapy. Furthermore, the use of adapted instruments without local validity and reliability testing may have affected the accuracy of the measurements. Nevertheless, these findings hold important implications for nursing practice, particularly in strengthening preventive efforts through foot care education, early screening for deformity risk, and enhanced monitoring of foot

conditions among diabetic patients in wound care clinics.

4. Conclusions and Suggestions

Foot deformities particularly toe deformities such as claw toe, hammer toe, mallet toe, and hallux valgus play a significant role in the development of diabetic ulcers among patients with diabetes mellitus. These deformities arise from structural changes caused by glycosylation, leading to reduced soft tissue elasticity and increased susceptibility to pressure injuries. Limited blood supply to the foot further aggravates this condition. The combination of deformity and compromised perfusion in the digital arteries makes the toes particularly prone to ulceration due to pressure from footwear or the deformity itself.

Claw toe is the most common type of foot deformity observed in patients with diabetes mellitus. This finding is consistent with evidence that nerve damage is a key factor in the pathogenesis of diabetic foot deformities, with the most distal extremities — such as the toes — being the first to be affected. Hallux valgus, on the other hand, results from bone misalignment in the first metatarsophalangeal joint, causing the great toe to deviate toward the other toes. Recent studies over the past decade have identified this condition as a multiplanar deformity involving rotational components. Pronation of the metatarsal bones contributes to the rounded appearance of the metatarsal heads, while supination pressure has been shown to aid in correcting the deformity.

Nurses play a pivotal role in educating patients with diabetes on proper foot monitoring to prevent complications. Comprehensive foot assessments should include evaluation of footwear, as inappropriate shoes can precipitate ulcer formation. During visual inspection, areas between the toes should be examined for ulcers, infections, calluses, or nail abnormalities. Furthermore, assessment of foot deformities is essential, as neuropathic imbalances can lead to common deformities such as hammer toe and claw toe.

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6. References

Ababneh, A., Bakri, F. G., Khader, Y., Lazzarini, P., & Ajlouni, K. (2020). Prevalence and associates of foot deformities among patients with diabetes in Jordan. Current Diabetes Reviews, 16(5), 471–482 DOI: 10.2174/1573399815666191001101910.

Armstrong, D. G., Tan, T.-W., Boulton, A. J. M., & Bus, S. A. (2023). Diabetic foot ulcers: a review. Jama, 330(1), 62–75 DOI: 10.1001/jama.2023.10578.

Arora, A., Behl, T., Sehgal, A., Singh, S., Sharma, N., Bhatia, S., Sobarzo-Sanchez, E., & Bungau, S. (2021). Unravelling the involvement of gut microbiota in type 2 diabetes mellitus. Life Sciences, 273, 119311 DOI: 10.1016/j.lfs.2021.119311.

Badahdah, H. M., Alshammari, S. F., Jassomah, O. M., Alharbi, A. J., Alsiwed, D. T., Althagafi, A. A., Babakr, R. A., Alsiwed, K. T., Al Zahib, Y. H., & Alhelali, L. N. (2024). Knowledge, Attitude, and Practice of Foot Care and the Risk of Foot Ulcers in Diabetic Patients in Jeddah, Saudi Arabia: A Cross-Sectional Study. Cureus, 16(3) DOI: 10.7759/cureus.12345.

Bekele, F., Chelkeba, L., Fekadu, G., & Bekele, K. (2020). Risk factors and outcomes of diabetic foot ulcer among diabetes mellitus patients admitted to Nekemte referral hospital, western Ethiopia: Prospective observational study. Annals of Medicine and Surgery, 51, 17–23 DOI: 10.1016/j.amsu.2020.01.005.

Bus, S. A., Lavery, L. A., Monteiro-Soares, M., Rasmussen, A., Raspovic, A., Sacco, I. C. N., van Netten, J. J., & Foot, I. W. G. on the D. (2020). Guidelines on the prevention of foot ulcers in persons with diabetes (IWGDF 2019 update). Diabetes/Metabolism Research and Reviews, 36, e3269 DOI: 10.1002/dmrr.326.

Chang, Y.-S., Tai, M.-C., Ho, C.-H., Chu, C.-C., Wang, J.-J., Tseng, S.-H., & Jan, R.-L. (2020). Risk of corneal ulcer in patients with diabetes mellitus: a retrospective large-scale cohort study. Scientific Reports, 10(1), 7388 DOI: 10.1038/s41598-020-64489-0.

Dayya, D., O'Neill, O. J., Huedo-Medina, T. B., Habib, N., Moore, J., & Iyer, K. (2022). Debridement of diabetic foot ulcers. Advances in Wound Care, 11(12), 666–686 DOI: 10.1089/wound.2021.0140.

Debattista, J., Gatt, A., & Formosa, C. (2021). The influence of deformity and limited joint mobility on foot ulceration in type 2 diabetes. Acta Scientific Orthopaedics (ISSN: 2581-8635), 4(10).

Dewi, F., & Hinchliffe, R. J. (2020). Foot complications in patients with diabetes. Surgery (Oxford), 38(2), 108–113 DOI: 10.1016/j.mpsur.2019.12.007.

Dismore, L. (2022). Patients' experiences of their forefoot problem in hallux valgus and/or

hallux rigidus: a triangulated longitudinal cohort study. Teesside University.

Edmonds, M., Manu, C., & Vas, P. (2021). The current burden of diabetic foot disease. Journal of Clinical Orthopaedics and Trauma, 17, 88–93 DOI: 10.1016/j.jcot.2021.01.012.

Gong, H., Ren, Y., Li, Z., Zha, P., Bista, R., Li, Y., Chen, D., Gao, Y., Chen, L., & Ran, X. (2023). Clinical characteristics and risk factors of lower extremity amputation in the diabetic inpatients with foot ulcers. Frontiers in Endocrinology, 14, 1144806 DOI: 10.3389/fendo.2023.1144806.

Hidayat, B., Ramadani, R. V., Rudijanto, A., Soewondo, P., Suastika, K., & Ng, J. Y. S. (2022). Direct medical cost of type 2 diabetes mellitus and its associated complications in Indonesia. Value in Health Regional Issues, 28, 82–89 DOI: 10.1016/j.vhri.2021.12.002.

Haile, K. E., Asgedom, Y. S., Azeze, G. A., Amsalu, A. A., Gebrekidan, A. Y., & Kassie, G. A. (2025). Diabetic foot: A systematic review and meta-analysis on its prevalence and associated factors among patients with diabetes mellitus in a sub-Saharan Africa. Diabetes Research and Clinical Practice, 111975. https://doi.org/10.1016/j.diabres.2024.111975

Jodheea-Jutton, A., Hindocha, S., & Bhaw-Luximon, A. (2022). Health economics of diabetic foot ulcer and recent trends to accelerate treatment. The Foot, 52, 101909 DOI: 10.1016/j.foot.2022.101909.

Kimura, T., Thorhauer, E. D., Kindig, M. W., Shofer, J. B., Sangeorzan, B. J., & Ledoux, W. R. (2020). Neuropathy, claw toes, intrinsic muscle volume, and plantar aponeurosis thickness in diabetic feet. BMC Musculoskeletal Disorders, 21, 1–10 DOI: 10.11604/pamj.2019.33.1.17810.

Kossioris, A., Tentolouris, N., Loupa, C. V, & Tyllianakis, M. (2019). The role of amputative and non-amputative foot deformities severity in the risk for diabetic ulceration classification systems building: a cross-sectional and case-control pilot investigation. Pan African Medical Journal, 33(1) DOI: 10.11604/pamj.2019.33.1.17810.

Iacopi, E., Pieruzzi, L., Riitano, N., Abbruzzese, L., Goretti, C., & Piaggesi, A. (2023). The weakness of the strong sex: Differences between men and women affected by diabetic foot disease. The International Journal of Lower Extremity Wounds, 22(1), 19–26. https://doi.org/10.1177/1534734620984604

Manisha, Niharika, Gaur, P., Goel, R., Lata, K., & Mishra, R. (2024). Understanding Diabetic Wounds: A Review of Mechanisms, Pathophysiology, and Multimodal Management Strategies. Current Reviews in Clinical and Experimental Pharmacology DOI: 10.2174/0127243441766623011211 0010.

Mekonnen, B. E., Wirtu, A. T., Kebede, M. A., Tilahun, A. G., & Degaga, T. K. (2021). Diabetics-Related Foot Deformity: Prevalence, Risk Factors. Knowledge and Practice. Trends Anat Physiol, 4(010) DOI: 10.15761/TAP.1000190.

Monteiro-Soares, M., Boyko, E. J., Jeffcoate, W., Mills, J. L., Russell, D., Morbach, S., & Game, F. (2020). Diabetic foot ulcer classifications: a critical review. Diabetes/Metabolism Research and Reviews, 36, e3272 DOI: 10.1002/dmrr.3272.

Moore, Z., Avsar, P., Wilson, P., Mairghani, M., O'Connor, T., Nugent, L., & Patton, D. (2021). Diabetic foot ulcers: treatment overview and cost considerations. In Journal of Wound Care (Vol. 30, Issue 10, pp. 786–791). MA Healthcare London DOI: 10.12968/jowc.2021.30.10.786.

Najefi, A.-A., Malhotra, K., Patel, S., Cullen, N., & Welck, M. (2022). Assessing the rotation of the first metatarsal on computed tomography scans: a systematic literature review. Foot & Ankle International, 43(1), 66–76 DOI: 10.1177/10711007211035012.

Nanayakkara, N., Curtis, A. J., Heritier, S., Gadowski, A. M., Pavkov, M. E., Kenealy, T., Owens, D. R., Thomas, R. L., Song, S., & Wong, J. (2021). Impact of age at type 2 diabetes mellitus diagnosis on mortality and vascular complications: systematic review and meta-analyses. Diabetologia, 64, 275–287 DOI: 10.1007/s00125-020-05323-5.

Ouyang, W., Jia, Y., & Jin, L. (2021). Risk factors of diabetic foot ulcer in patients with type 2 diabetes: a retrospective cohort study. American Journal of Translational Research, 13(8), 9554.

Polikandrioti, M., Vasilopoulos, G., Koutelekos, I., Panoutsopoulos, G., Gerogianni, G., Babatsikou, F., Zartaloudi, A., & Toulia, G. (2020). Quality of life in diabetic foot ulcer: associated factors and the impact of anxiety/depression and adherence to self-care. The International Journal of Lower Extremity Wounds, 19(2), 165–179 DOI: 10.1177/1534734620914596.

Primadhi, R. A., & Herman, H. (2021). Diabetic foot: Which one comes first, the ulcer or the contracture? World Journal of Orthopedics, 12(2), 61 DOI: 10.5312/wjo.v12.i2.61.

Rossboth, S., Lechleitner, M., & Oberaigner, W. (2021). Risk factors for diabetic foot complications in type 2 diabetes—a systematic review. Endocrinology, Diabetes & Metabolism, 4(1), e00175 DOI: 10.1002/edm2.175.

Rubio, J. A., Jiménez, S., & Lázaro-Martínez, J. L. (2020). Mortality in patients with diabetic foot ulcers: causes, risk factors, and their association with evolution and severity of ulcer. Journal of Clinical Medicine, 9(9), 3009 DOI: 10.3390/jcm9093009.

Sutkowska, E., Sutkowski, K., Sokołowski, M., Franek, E., & Dragan Sr, S. (2019). Distribution of the highest plantar pressure regions in patients with diabetes and its association with peripheral neuropathy, gender, age, and BMI: one centre study. Journal of Diabetes Research, 2019(1), 7395769 DOI: 10.1155/2019/7395769.

Theocharidis, G., & Veves, A. (2020). Autonomic nerve dysfunction and impaired diabetic wound healing: The role of neuropeptides. Autonomic Neuroscience, 223, 102610 DOI: 10.1016/j.autneu.2020.102610.

Tsaklis, P. V, & Tentolouris, N. (2024). Biomechanics of the Diabetic Foot: The Road to Foot Ulceration. In The Diabetic Foot: Medical and Surgical Management (pp. 233–252). Springer DOI: 10.1007/978-3-031-28234-3_14.

Wagner, E., & Wagner, P. (2020). Metatarsal pronation in hallux valgus deformity: a review. JAAOS Global Research & Reviews, 4(6), e20 DOI: 10.5435/JAAOSGlobal-D-20-00012

Wang, X., Yuan, C.-X., Xu, B., & Yu, Z. (2022). Diabetic foot ulcers: Classification, risk factors and management. World Journal of Diabetes, 13(12), 1049 DOI: 10.4239/wjd.v13.i12.1049.

Yosa, D., & Wibowo, A. (2023). Correlation between blood urea and creatinine level in patients with diabetes melitus at the ministry of marine and fishery clinic, Indonesia. The International Conference on Public Health Proceeding, 4(02), 576–584 DOI: 10.47606/icophp.v4i2.601.