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Awareness and Behaviour on Foot Care among Patients with Type 2 Diabetes Mellitus in Endocrine Clinic, HTAR, Selangor

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Abstract
Diabetic foot complications result in morbidity and lower extremity amputation. This cross-sectional study aimed to assess the foot care behavior among patients with Diabetes Mellitus. More than half of the participants (56.2%) reported a low level of foot care behavior. Gender and educational level were significantly associated with foot care behavior with p-values of 0.044 and 0.001, respectively. This study provided an insight into the current situation of foot care among patients with Diabetes Mellitus. Further research is needed to explore the new method in giving health education for behavioral change thus reducing foot complications among diabetes patients.

Keywords: Self-awareness, Diabetes Mellitus, Footcare, Behavior

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1.0 Introduction

The prevalence of patients with Diabetes mellitus has increased in recent years (Lin et al, 2020). Diabetes foot complications have a significant impact on patients. Diabetic foot can be defined as infection, ulceration, or destruction of foot tissues associated with neuropathy and peripheral arterial disease of people with diabetes mellitus (DM) (IWGDF, 2020). About 80% of non-traumatic lower-limb amputations in patients with DM preceded a diabetic foot ulcer (DFU). Around 50% of people with DM die within five years of developing a DFU, and up to 70% die within five years after an amputation (NICE, 2015). Thus, it is a major burden to the patients, healthcare professionals, and healthcare system. Diabetic foot requires thorough attention and coordinated management, preferably by a multidisciplinary foot care team and optimal management of diabetic foot can reduce the incidence of infection-related morbidities, the need, and duration for hospitalization, and the incidence of major limb amputation (Ministry of Health Malaysia,2018). All healthcare professional providers need prompt intensive efforts, and guidelines are necessary to ensure standardization and effectiveness in diabetic foot care.

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2.0 Literature Review

2.1 Diabetes Mellitus

Diabetes Mellitus (DM) is a metabolic disorder characterized by elevated glucose levels due to insufficient insulin secretion, reduced insulin action, with carbohydrate, fat, and protein metabolism disturbances. The common symptoms of DM are excessive urination, blurring vision, fatigue, numbness of extremities, and skin infections [American Diabetes Association (ADA), 2014]. In addition to these common symptoms, older adults with Diabetes may experience fatigue, blurred vision, gain or loss of weight gain or loss, and conditions such as foot/leg wound, virginities, urinary tract infection, numbness of extremities and vision changes (Prajapati, 2019).

According to Pippitt, Li, and Gurgle (2016), an initial diagnosis occurs when FPG level is more than 126 milligrams per deciliter (mg/dL); an HbA1C level of more than 6.5%; a random plasma glucose level of more than 200 mg per dL; or a 75g 2 hours OGTT with a plasma glucose level of more than 200 mg/dL. If the result is borderline, yearly screening is suggested (Garber et al., 2019). There are several treatments for DM management. Most patients with DM usually take oral antidiabetic drugs (OAD) medication, but insulin therapy may require in severe cases and uncontrolled Diabetes (Kodner et al., 2017).

DM complications can be categorized into acute or chronic. The acute complication is a severe and life-threatening condition such as diabetic ketoacidosis (DKA), hyperglycemia, hyperosmolar state, and hypoglycemia, whilst the chronic complications are classified as macrovascular (myocardial infarction, cerebrovascular and peripheral vascular disease and comorbidity) and microvascular diseases (diabetic nephropathy, retinopathy, and neuropathy) (Li et al., 2019; World Health Organization, 2014).

2.2 Foot care Behavior (Foot Hygiene)

Maintaining good foot hygiene is essential to reducing the risk of diabetic foot complications. A cross-sectional study conducted in Kuwait reported that 67.5% of the study participants washed their feet more than once daily (Alsaleh et al., 2021). Older adults with Diabetes in Malaysia also reported that they washed their feet more than once a day (Ahmad Sharoni et al., 2017). Contrarily, in another descriptive study, only 1% of the patients with Diabetes washed their feet more than once daily (Mbisi et al., 2019). Hanley et al. (2020) mentioned that four out of five patients with Diabetes were overweight with a big stomach, which acted as a barrier for them to wash their feet properly. Other than washing the feet, keeping the toes dry is important to prevent fungal infection and skin damage (Ahmad Sharoni et al., 2017).

Nail trimming is a part of foot care behavior but improper equipment such as sharp can cause minor injury (Chiwanga & Njelekela, 2015). Al-Gaows and Al-Zahrani (2019), reported 351 of 404 of their participants never used the sharp instrument during nail trimming. Trimming toenails straight can prevent toenails damage (Pourkazemi et al., 2020). However, a multi-centered study in Lahore reported that most of the patients with Diabetes (81.5%) never regularly trimmed their toenails (Akhtar et al., 2018).

2.3 Foot Care Behavior (Footwear)

Clinical Practice Guidelines for Management of Diabetic Foot Care by Ministry of Health Malaysia (2018) suggested using shoes with lace-up, Velcro, or strap fastening for patients with Diabetes. Only 31.2% of the patients wore proper shoes all the time (Saber & Daoud, 2018) and 37.5% of them wore proper shoes sometimes (Alsaleh et al., 2021). More than half of the patients (51.2%) sometimes wore shoes without socks (Mbisi et al., 2019) and 40.1% never wear socks (Alsaleh et al., 2021). AlOwais and Shido (2020) reported 58.6% of the patients with Diabetes rarely wore cotton socks. Alsaleh et al. (2021) reported 68.6% of the patients changed their socks daily but a study conducted in Ethiopia mentioned that 75.4% of participants changed their socks less than four times a week (Seid & Tsige, 2015). Patients with Diabetes are lack of awareness related to the proper footwear, as previous literature reported 45.4% of them never wore trainers (Alsaleh et al., 2021) and only 46.3% wore appropriate footwear (Sari et al., 2020). Several studies conducted in Malaysia reported similar findings. A study in Kuantan by Azmi et al. (2020) reported 42.2% wore broad, round shoes, 4.7% wore pointed shoes, and 66.2% wore flip-flops. Ahmad Saroni et al. (2017) emphasized the need to break into new shoes to prevent foot injury.

2.4 Foot Care Behavior (General Foot Care Practice)

General foot care practice is poor among patients with Diabetes. A previous study reported only 41.2% practiced daily feet examination (Seid & Tsige, 2015). Other studies also showed poor foot care practice, with 70% of the patients never examining their feet, 61.1% to 85.5% never inspected the shoes before wearing them, 23.8% never inspected inside the shoes before wearing them, 16.5% never inspected the shoes after taking them off and 71.9% walked barefoot and 51.5% sometimes were barefoot outside the house (Akthar et al., 2018; Mbisi et al., 2019; Solan et al., 2016; Tuglo et al., 2021). Chiwanga & Njelekela (2015) conducted a study in Tanzania and found out that only 43.2% of participants never walked barefoot inside the house. A study in Kuantan, Malaysia conducted by Azmi et al. (2020) revealed that most Malay patients walked barefoot due to cultural influences. In Malaysia, merely half of the patients (56.1%) practiced inspecting their shoes before wearing them (Muhammad-Lufti et al., 2014). Mbisi et al. (2019) reported 51.5% rate of applied dressing on a blister and Alsaleh et al. (2021) revealed 34.5% sometimes applied dressing to a blister, and 21% never applied dressing to graze, cut or burn.

However, one study conducted in Ethiopia showed better foot care practice among the patients with Diabetes with only 12% of participants never checking the shoes before wearing them, 78.4% and 86.5% never walked barefoot inside and outside the house, respectively (Hirpha et al., 2020). A study in Kuwait reported that 69.7% of the participants never put their feet near the fire, 63.3% never used a radiator (Alsaleh et al., 2021).

2.5 Level of Foot Care Behavior

A study by Mehmood et al. (2018) with 488 participants in Dubai reported that poor foot care practice in 46% of participants, average practice in 26% of participants, and good practice in only 28% of the participants. According to Sulistyo et al., (2020), diabetic foot care behaviors among 72 participants in Indonesia are at a poor level (M = 46.7, SD = 10.9%), with 86.4 % of participants having poor foot care practice and the remaining 12.3 % having moderate practice. A cross-sectional study by Kamaru Zaman et al. (2018) conducted in Kuala Lumpur, Malaysia with 81 participants showed that 49.4% had poor practice of foot care, 44.4% had fair practice, and only 6.2% with good practice. In contrast, Yilmaz et al. (2019) mentioned that study participants had moderate footcare behavior, and only one-third of the patients had poor footcare levels. Another study by Seid and Tsige (2015) showed that more than half of the study participants in Ethiopia had good level foot care behavior.

In view of the importance of foot care and lack of consistencies among previous studies, we aimed to investigate the foot care behavior among patients with type 2 DM. Specifically, our objectives include: 1) to assess the level of foot care behavior among patients with type 2 DM and 2) to determine the association between demographic characteristics and foot care behavior.

3.0 Methodology

3.1 Study design, study setting, and population

This study was a cross-sectional survey conducted among patients with Type 2 DM attending the Endocrine Clinic, Hospital Tengku Ampuan Rahimah Klang, from April 2021 until July 2021.

3.2 Sampling method and sample

The total population was 420 patients with DM. The final sample needed was 242 participants after being added with a 20% attrition rate by using the Raosoft sample size calculation. The inclusion criteria were aged 18 years old and above for consent purposes. Patients were excluded if they were illiterate in Malay or English as they might not be able to answer the questionnaire. Patients with diabetes complications such as post CVA and DFU were excluded from this study as they were unable to perform self-care.

3.3 Research instruments

A self-administered, bilingual (English and Malay) questionnaire was used in this study. The questionnaire was derived from Lincoln et al. (2007) with written permission from the original author to use the instrument. The questionnaire consists of two parts: Part 1 for sociodemographic data and Part 2 for Nottingham Assessment of Functional Footcare (NAFF).

3.4 Reliability and validity

Validity of the instruments was sought from six experts and a content validity index was calculated. Reliability for the instrument was performed with the Cronbach Coefficient Alpha test with the value of 0.7 and a pilot study was conducted on 30 participants who met the inclusion criteria.

3.5 Data collection

The data collection was conducted from 1 April 2021 to 31 July 2021 and eligible participants were selected using the convenience sampling method. Consented participants were given a set of self-administered questionnaires to answer. It took about 15 to 20 minutes to answer the questionnaire. Participants were instructed to enclose it in the envelope provided and then put it in the box prepared by the researchers to maintain anonymity.

3.6 Data analysis

Data were analyzed using the Statistical Package for Social Science version 25. The descriptive analysis was used to measure frequency, the percentage of gender, age, ethnicity, marital status, duration of DM, education level, and foot care behavior: foot hygiene, footwear, and general foot care practice. The Chi-square with Fisher's Exact Test was used to answer the research question, to determine the association between sociodemographic data with the level of foot care behavior.

4.0 Findings

4.1 Demographic characteristics

In this study, female respondents (57.9%) were more than male respondents with the majority of the participants aged 40 to 60 years old (51.4%). Most of the participants were Malay (45.5%) and married (73.6%). More than a quarter had DM for six to ten years (30.6%) and attended secondary school (52.1%). Table 1 summarizes the demographic characteristic of this study.

Table 1: Description of demographic characteristics among diabetic patient (N=242)

Variables	Categories	Frequency	Percentage (%)
Gender	Male	102	42.1
	Female	140	57.9
Age	< 20 years	9	3.7
	21 – 40 years	80	33.1
	41 – 60 years	125	51.7
	> 60 years	28	11.6
Race	Malay	110	45.5
	Chinese	25	10.3
	Indian	99	40.9
	Others	8	3.3
Marital status	Single	40	16.5
	Married	178	73.6
	Widow/widower	24	9.9
Years of disease	< 5 years	50	20.7
	6 – 10 years	74	30.6
	11 – 15 years	59	24.4
	15 – 20 years	36	14.9
	> 20 years	23	9.5
Educational level	No formal education	18	7.4
	Primary school	25	10.3
	Secondary school	126	52.1
	Higher education	73	30.2

4.2 Foot Hygiene Among Diabetes Patients

There were 43% of this study participants wash their feet more than once a day, but 40% of them sometimes keep their feet dry, and 41.7% never keep their in-between toes dried. However,39.3% never applied moisturizing cream, and 43.8% never applied it between their toes. More than half of the participants (51.7%) cut their toenails once a month.

4.3 Footwear Among Diabetes Patients

Most of the participants (47.5%) used to wear slippers without fastenings most of the time. More than half (63.6%) never wear trainers, and 59.5% never wear shoes with lace-up, Velcro, or strap fastenings. 59.1 % never wear pointed-toed shoes. However, 40.9% of participants usually wear flip-flops/mules. Moreover, 62.4% never or rarely broke into new shoes, and 58.7% never wore artificial fiber socks. There were 60.7% of participants changed their socks once daily.

4.4 General Footcare Practice Among Diabetes Patients

In this study, 46.3% of the participants examined their feet daily, 36% sometimes checked inside the shoes before wearing them, and 39.3% never checked the shoes after taking them off. Most of the participants (40.1%) often walked barefoot inside the house and 64.4% never walked barefoot outside the home. Study also found that 75.2% of participants never used hot water on the bed, 99.2% never put their leg near the fire, and 86.4% never put their foot on the radiator. More than half (69.4%) never used corn remedies, corn plasters, or paints, 59.1% never put a dry dressing on a blister, and 46.7% never used a dry dressing on graze, cut, or burn.

4.5 Level of Footcare Behavior

Level of foot care was divided into two categories: high level for participants with a total score of more than 50, meanwhile low level for the participants with a total score of less than 50. More than half of the participants (56.2%) had a low level of foot care behavior compared to 43.8% (n=106) of participants who had a high level of foot care behavior.

4.6 Association Between Demographic Characteristics with Level of Footcare Behavior

There was significant association between gender and level of foot care with $\chi 2=4.058$, $P=0.044$, as more than half of the participants who had a high level of foot care behavior were female (65.1%). However, this association was very weak with Phi and Cramer's value of 0.129. So, the null hypothesis was rejected, and the alternative hypothesis was accepted.

There was no significant association between age (χ1=5.764, P=0.124) and level of foot care behavior, race (χ1=5.955, P=0.114), marital status (χ1=0.59, P=0.775) with very weak associated (0.046), and duration of Diabetes (χ1=1.326, P=0.857) with the level of foot care behavior. Therefore, the null hypothesis was accepted.

A highly significant association was found between education level and level of foot care behavior (χ1=16.148, P=0.001). There was a moderate association between education level and level of foot care behavior (0.258). The null hypothesis was rejected, and the alternative hypothesis was accepted.

Table 2: Level of footcare behavior and its association with demographic characteristics

Item	High level	Low level	Value Chi-Square (χ1)	P-value	Phi and Cramer's V
Gender					
Male	37	65	4.058	0.044	0.129
Female	69	71			
Age					
< 20 years	4	5			
21 – 40 years	40	40	5.764	0.124	0.154
41 – 60 years	46	79			
> 60 years	16	12			
Race					
Malay	52	58			
Chinese	6	19	5.955	0.114	0.157
Indian	46	53			
Other	2	6			
Marital status					
Single	17	23			
Married	80	98	0.509	0.775	0.046
Widow/widower	9	15			
Duration of disease					
< 5 years	24	26			
6 – 10 years	32	42			
11 – 15 years	27	32	1.326	0.857	0.074
16 – 20 years	13	23			
> 20 years	10	13			
Education level					
No formal education	2	6			
Primary school	8	17	16.148	0.001	0.258
Secondary school	53	73			
Higher education	43	30			

**Significant at p-value <0.05*

5.0 Discussion

Foot hygiene is an essential part of foot care behavior and can reduce the risk of foot complications. In this study, more than half of the respondents had a low level of foot care behavior. This result was consistent with studies conducted in North Iran, and Bangalore with majority of their subjects had a low level of foot care behavior (Pourkazemi et al., 2020, Manjunath & Nandini, 2020). Another study by Sen et al. (2019) also showed half of the participants had low footcare behavior. In Malaysia, it was consistent with a study in Kuantan, Pahang by Azmi et al. (2020), which showed that half of the study subjects had poor foot care practice and poor awareness of foot care practice. Future study is warranted to examine the foot care behavior among type 2 diabetes patients in long term.

Contrarily, Yilmaz et al. (2019) mentioned that most study participants had moderate footcare behavior, and only one-third of the participants had poor footcare levels. Another study by Seid &Tsige (2015) showed that more than half of the study participants in Ethiopia had good level foot care behavior. A study in Indonesia by Sari et al. (2020) mentioned that half of the study subjects were concerned about foot care behavior which indicated a high level of foot care behavior. In Malaysia, Kamaru Zaman et al. (2018) found that half of the study participants in Kuala Lumpur had fair and good foot care behavior.

This study reported a significant association between gender and level of foot care. This finding was similar to several studies by Al-Gaows & Al-Zahrani (2019). In comparison, there was no significant association between gender and level of foot care in Vietnam and India by Sen et al. (2019) and Pitchai & Joshi (2015). There are different foot care habits between males and females, which women usually wear improper footwear (Barwick et al., 2019). However, a study reported foot care practices were higher among men as most females neglect foot care because they are too busy with housework and family needs (Ahmad Sharoni et al., 2017).

Finding also shows that there is no significant association between age and foot care level, similar to a study by Solan et al. (2016). However, a study by Gurmu et al. (2018) showed that there was a significant correlation between foot care practice and age ($p < 0.05$), in which participants aged 40 to 59 years practice good foot care habits (CI=6.35). Miikkola et al. (2019) have shown that increasing age is associated with foot care practice, where they had limited movement as skin and nail structure changes. Changes in foot shapes and characteristics inhibit good foot care practice among the elderly (Menz, 2015). Limited vision and other chronic diseases inhibited good footcare practices among the elderly and could not evaluate their feet.

There was no significant association between race and foot care practice in this study. It was similar to a study by Devarajooh & Chinna (2017) that also found that all ethnic groups in Malaysia practiced equal foot care. It contrasts with the outcomes of a study in Kuantan, which identified that race can influence foot care practice, with Malay affecting foot care practice as they always walk around the house barefoot (Azmi et al., 2020). A qualitative study may be useful to explore the cultural aspects of different races in Malaysia and examine how races may influence different foot care practices among races.

There was no significant association between marital status and foot care practice, and this was similar to studies by Solan et al. (2016) and Alshammari et al. (2019). In comparison, Tuha et al. (2021) and Azmi et al. (2020) reported that marital status influenced foot care practice, which married participants had good foot care practice compared to the single participants. Higher perceived social support from significant others, family and friends showed greater self-care to prevent DFU (Laopoulou et al., 2020). As our study was a cross sectional design that may not be able to establish the causal relationship between marital status and foot care practice. Future research with rigorous design is needed to examine the relationship between marital status and foot care practice, and how social support can affect the foot care practice.

The findings of this study revealed there was no obvious difference in the level of foot care behavior with the duration of disease. It was similar to a study in Malaysia by Azmi et al. (2020), who mentioned that the period of DM had no significant relationship with foot care practice. However, Pourkazemi et al. (2020) reported that disease duration was significantly associated with foot care practice and mentioned that patients with ten years of DM were more compliant with foot care practice. Besides, Gurmu et al. (2018) revealed that participants with more than ten years of DM practice good foot care behavior. The long-term disease provides an opportunity for the patients to learn about the condition and their day-to-day experiences.

The level of education was a factor that affected foot care habits. There was a significant association between education level and foot care behaviour level. It was similar to a study in Iran, in which most high education participants do not practice good foot care habits (Pourkazemi et al., 2020). Similarly, Gurmu et al. (2018) found that participants with secondary school education (CI-3.37, $p<0.05$) and suggested more emphasis on foot and self-care habits for participants with low education levels.

6.0 Conclusion and Recommendations

The findings of our study give an overview of the diabetic foot care behavior among patients the type 2 DM. Our results are preliminary findings which may be useful for future experimental study to improve the patient outcomes. It may also contribute to the improvement of diabetic food education by focusing on the areas of poor diabetic foot care behavior.

There were several recommendations following this study. Comprehensive health education needs to be delivered on a large scale to the patient and family members and caretakers to increase self-awareness as family members/caretakers are able to remind patients and involve them in their foot care to prevent further complications.

Health education on foot care behavior should be delivered effectively using mass media. In this era, using mass media is more effective because nowadays, even older people use internet technology to search for health information. As we can see, many doctors and physicians are using social media platforms such as Facebook, Instagram and Tiktok to deliver health education and awareness about health information. For example, using Tiktok or YouTube channel to provide the foot care behavior content and awareness is more up to date and following globalization.

Other than that, further research needs to be done in different study settings to get different sociodemographic characteristics of the respondents, thus enhancing in exploring more problems about foot care behavior because this condition was at an alarming rate in a health setting and country.

Our study has some limitations. First, due to the nature of the study with cross sectional design, our findings need to be interpreted with caution as causal effects may not be establish the causal effect. Also, the participants were only recruited from a single center that may not be able to be generalized to the whole diabetes mellitus population. Finally, as the outcomes were based on self-reported questionnaires, we were unable to exclude the potential response bias from the participants where they could answer based on the socially desirable response.

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References

Ahmad Sharoni, S. K., Abdul Rahman, H., Minhat, H. S., Shariff Ghazali, S., & Azman Ong, M. H. (2017). A self-efficacy education programme on foot self-care behaviour among older patients with Diabetes in a public long-term care institution, Malaysia: A Quasi-experimental Pilot Study. *BMJ open*, *7*(6), e014393. https://doi.org/10.1136/bmjopen-2016-014393

Akhtar, K., Ali, A., & Bhatti, R. (2018). Knowledge and Practice of Foot Care among Diabetic Patients at a Public Tertiary Care Hospital Lahore. *National Journal of Health Sciences*, *3*(4), 139-144.

Al-Gaows, F., & Alzahrani, A. (2019). Knowledge and practice of foot care among diabetic patients attending diabetic care center in Jeddah City. *Int. J. Med. Rev. Case Rep*, *3*(11), 1.

AlOwais, M. M., & Shido, O. A. (2020). Knowledge and practice of foot care in patients with diabetes mellitus attending primary care center at Security Forces Hospital, Riyadh, Saudi Arabia: A cross-sectional study. *Journal of Family Medicine and Primary Care*, *9*(12), 5954.

Alshammari, Z., Alsaid, L., Parameaswari, P., & Alzahrani, A. (2019). Attitude and knowledge about foot care among diabetic patients in Riyadh, Saudi Arabia. *Journal of Family Medicine and Primary Care*, *8*(6), 2089. https://doi.org/10.4103/jfmpc.jfmpc_248_19

Alsaleh, F. M., AlBassam, K. S., Alsairafi, Z. K., & Naser, A. Y. (2021). Knowledge and practice of foot self-care among patients with Diabetes attending primary healthcare centres in Kuwait: A cross-sectional study. *Saudi Pharmaceutical Journal*. https://doi.org/10.1016/j.jsps.2021.04.006

American Diabetes Association. (2014). *Skin Complications | ADA*. Retrieved from https://www.diabetes.org/diabetes/complications/skin-complications

Azmi, N.H, Abdul Hadi, A., Md. Aris, M.A, Nasreen, H.E, & 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 Medical Journal Malaysia, 19(2). Retrieved from https://doi.org/10.31436/imjm.v19i2.1560

Barwick, A. L., Hurn, S. E., van Netten, J. J., Reed, L. F., & Lazzarini, P. A. (2019). Factors associated with wearing inadequate outdoor footwear in populations at risk of foot ulceration: A cross-sectional study. *PloS one*, *14*(2), e0211140. https://doi.org/10.1371/journal.pone.0211140

Bonner, T., Foster, M., Spears-Lanoix. E. (2016). Type 2 diabetes-related foot care knowledge and foot self-care practice 00interventions in the United States: a systematic review of the literature. Diabetic Foot and Ankle 7: 29758

Chatterjee, S., Basu, M., Bandyopadhyay, K., De, A., & Dutta, S. (2017). Knowledge and practice of foot care amongst diabetic patients attending a tertiary care hospital of Kolkata, India. *J Prevent Medi Holistic Health*, *3*(1), 15-21.

Chiwanga, F. S., & Njelekela, M. A. (2015). Diabetic foot: prevalence, knowledge, and foot self-care practices among diabetic patients in Dar es Salaam, Tanzania – a cross-sectional study. *Journal of Foot and Ankle Research*, *8*(1), https://doi.org/10.1186/s13047-015-0080-y

Clinical Practice Guideline. (2018). Management of Diabetic Foot. 2nd ed. Ministry of Health Malaysia. Retrieved from https://mdes.org.my/2019/05/01/cpg-management-of-diabetic-foot-second-edition-2018/

Devarajooh, C., & Chinna, K. (2017). Depression, distress and self-efficacy: The impact on Diabetes self-care practices. *PloS one*, *12*(3), e0175096.

Gurmu, Y., Gela, D., & Aga, F. (2018). Factors associated with self-care practice among adult diabetes patients in West Shoa Zone, Oromia Regional State, Ethiopia. *BMC health services research*, *18*(1), 732. Retrieved from https://doi.org/10.1186/s12913-018-3448-4

Hanley, G., Chiou, P., Liu, C., Chen, H., & Pfeiffer, S. (2020). Foot care knowledge, attitudes and practices among patients with diabetic foot and amputation in St. Kitts and Nevis. *International Wound Journal*, *17*(5), 1142–1152. https://doi.org/10.1111/iwj.13446

Hirpha, N., Tatiparthi, R., & Mulugeta, T. (2020). Diabetic Foot Self-Care Practices Among Adult Diabetic Patients: A Descriptive Cross-Sectional Study. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy*, *Volume 13*, 4779–4786. https://doi.org/10.2147/dmso.s285929

Kamaru Zaman, N.H, Mohd Shah, N.S., & Hussein, S.Z. (2018). Knowledge and Practice Foot Care Among Diabetic Elderly in Ukm Medical Centre (UKMMC). *The Malaysian Journal of Nursing (MJN)*, *9*(3), 6-12. Retrieved from https://ejournal.lucp.net/index.php/mjn/article/view/378

Laopoulou, F., Kelesi, M., Fasoi, G., Vasilopoulos, G., & Polikandrioti, M. (2020). Perceived social support in individuals with diabetic foot ulcers: a cross-sectional survey. *Journal of Wound Ostomy & Continence Nursing*, *47*(1), 65-71.

Li, J., Cao, Y., Liu, W., Wang, Q., Qian, Y., & Lu, P. (2019). Correlations among Diabetic Microvascular Complications: A Systematic Review and Meta-analysis. *Scientific Reports*, *9*(1). https://doi.org/10.1038/s41598-019-40049-z

Lin, X., Xu, Y., Pan, X., Xu, J., Ding, Y., Sun, X., Song, X., Ren, Y., & Shan, P. F. (2020). Global, regional, and national burden and trend of Diabetes in 195 countries and territories: an analysis from 1990 to 2025. *Scientific reports*, *10*(1), 14790. https://doi.org/10.1038/s41598-020-71908-9

Magbanua, E. & Lim-Alba, R. (2017). Knowledge and Practice of Diabetic Foot Care in Patients with Diabetes at Chinese General Hospital and Medical Center. *Journal of the ASEAN Federation of Endocrine Societies*, *32*(2), 123–131. https://doi.org/10.15605/jafes.032.02.05

Manjunath, M. & Nandini, T. (2020). Prospective study on the knowledge and practice of foot care among diabetic patients. *International Journal of Basic & Clinical Pharmacology*, *9*(6), 924. https://doi.org/10.18203/2319-2003.ijbcp20202183

Mbisi, A. M., Gitonga, L. K., & Kiruki, S. (2019). Foot care practices among type 2 diabetics mellitus patients attending diabetes clinics in Embu County, Kenya. *Open Journal of Clinical Diagnostics*, *9*(04), 126.

Mehmood, M., Parkar, A., Mustafa, N., Mustafa, S., Makin, M., Alawadi, F. and Farghaly, S. (2018). Diabetic foot self-care: awareness and practice among type 2 diabetic patients in primary healthcare centers, Dubai Health Authority. *International Journal of Community Medicine and Public Health*, 6(1), p.1.

Miikkola, M., Lantta, T., Suhonen, R., & Stolt, M. (2019). Challenges of foot self-care on older people: a qualitative focus-group study. *Journal of Foot and Ankle Research. 12* (5). https: doi.org/10.1186/s13047-019-0315

Muhammad-Lutfi A.R., Zaraihah, M.R, Anuar-Ramdhan, I.M. (2014). Knowledge and practice of diabetic foot care in an in-patient setting at a tertiary medical centre. Malays Orthop J.8(3):22-6.

Parker, J., Scharfbillig, R., & Jones, S., (2017). Moisturisers for the treatment of foot xerosis: a systematic review. *Journal of foot and ankle,10*(9). https://doi.org/10.1186/s13047-017-0190-9.

Pippitt, K., Li, M., & Gurgle, H. E. (2016). Diabetes Mellitus: Screening and Diagnosis. *American family physician*, *93*(2), 103–109.

Pitchai, P., & Joshi, J. (2015). Knowledge and practice of foot care amongst diabetics in India: comparison between urban and rural setting-a reality check. *Int J Health Sci Res*, *5*(4), 181-189.

Pourkazemi, A., Ghanbari, A., Khojamli, M., Balo, H., Hemmati, H., Jafaryparvar, Z., & Motamed, B. (2020). Diabetic foot care: knowledge and practice. *BMC endocrine disorders*, *20*(1), 40. https://doi.org/10.1186/s12902-020-0512-y

Prajapati, A. K. (2019). Urinary Tract Infection in Diabetics. Microbiology of Urinary Tract Infections - Microbial Agents and Predisposing Factors. doi:10.5772/intechopen.79575

Sari, Y., Upoyo, A. S., Isworo, A., Taufik, A., Sumeru, A., Anandari, D., & Sutrisna, E. (2020, February 1). *Foot self-care behavior and its predictors in diabetic patients in Indonesia*. BMC Research Notes. 13(38). https://doi.org/10.1186/s13104-020-4903-y

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. https://doi.org/10.1155/2015/934623.

Sen, H. T. N., Janepanish Visudtibhan, P., & Siripitayakunkit, A. (2019). Factors Related to Foot Care Behaviors Among Patients with Type 2 Diabetes Mellitus in DaNang, Vietnam. *Ramathibodi Medical Journal*, *42*(3), 57 - 68. https://doi.org/10.33165/rmj.2019.42.3.162035

Solan, Y. M., Kheir, H. M., Mahfouz, M. S., Al-Faify, A. A., Hakami, D. T., Faifi, M. A. A., Hakami, A. W., Hakami, A. H., & Sharif, H. H. (2016). Diabetic Foot Care: Knowledge and Practice. *Journal of Endocrinology and Metabolism*, *6*(6), 172–177. Retrieved from https://doi.org/10.14740/jem388e

Sulistyo A.H.S., Sae-Sia W., Maneewat K. (2020). Diabetic Foot Care Knowledge and Behaviors of Individuals with Diabetes Mellitus in Indonesia. Retrieved 20 August 2020, from http://dl6.globalstf.org/index.php/jnhc/article/view/1999/2003

Świątoniowska, N., Chabowski, M., & Jankowska-Polańska, B. (2020). Quality of Foot Care
Among Patients With Diabetes: A Study Using a Polish Version of the Diabetes Foot Disease and Foot Care Questionnaire. *The Journal of foot and ankle surgery: official publication of the American College of Foot and Ankle Surgeons*, *59*(2), 231–238. https://doi.org/10.1053/j.jfas.2019.07.020

Tuglo, L. S., Nyande, F. K., Agordoh, P. D., Nartey, E. B., Pan, Z., Logosu, L., Dei Hlorlewu, A. E., Haligah, D. K., Osafo, L., Taful, S., & Chu, M. (2021). Knowledge and practice of diabetic foot care and the prevalence of diabetic foot ulcers among diabetic patients of selected hospitals in the Volta Region, Ghana. *International Wound Journal*. https://doi.org/10.1111/iwj.1365.

Tuha, A., Faris, A. G., Andualem, A., & Ahmed Mohammed, S. (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.

World Health Organization. (2014, June 4). *WHO | About Diabetes*. Retrieved from https://www.who.int/diabetes/action_online/basics/en/index3.

Yılmaz Karadag, F., Saltoglu, N., Ak, O., Çınar Aydın, G., Şenbayrak, S., Erol, S. Mıstanoglu Ozatag, D., Kadanalı, A., Kuçukardalı, Y., Çomoglu, Ş., Yoruk, G., Akkoyunlu, Y., Meriç Koç, M., & Altunçekiç Yıldırım, A. (2019). Foot self-care in diabetes mellitus: Evaluation of patient awareness. *Primary care diabetes*, *13*(6),515–520. https://doi.org/10.1016/j.pcd.2019.06.003