



Foot Care Behaviour among Patients with Type 2 Diabetes Mellitus in Malaysia: A cross-sectional study

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Abstract

Diabetic foot complications result in morbidity and lower extremity amputation. Our cross-sectional study aimed to assess the foot care behaviour among patients with type 2 diabetes mellitus. More than half of the participants (56.2%) reported a low level of foot care behaviour. Gender and educational level were significantly associated with foot care behaviour ($p < 0.05$). This study provides an overview of the current foot care behaviour in a multi-ethnic population in Southeast Asia. Future studies with rigorous methods are needed to examine the factors associated with the foot care behaviour among patients with type 2 diabetes mellitus.

Keywords: foot care; behaviour; diabetes mellitus; cross-sectional

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1.0 Introduction

In recent years, the prevalence of people with diabetes mellitus (DM) has increased (Lin et al, 2020). One of the major complications of diabetes include diabetic foot problems, and the its complications have a significant impact on patients. Diabetic foot occurs in people with DM and it can be defined as infection, ulceration, or destruction of foot tissues associated with neuropathy and peripheral arterial disease (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, DFU is a major burden to the patients, health care professionals, and health care system. Diabetic foot requires thorough attention and coordinated management, preferably by a multidisciplinary foot care team as optimal management of diabetic foot can reduce the incidence of infection-related morbidities, hospitalisation, and the incidence of major limb amputation (Ministry of Health Malaysia, 2018). Prompt intensive efforts by all health care providers are needed and guidelines are necessarily required to ensure standardisation and effectiveness in diabetic foot care among patients with Type 2 DM.

2.0 Literature Review

Diabetes Mellitus (DM) is a metabolic disorder characterised by elevated glucose levels due to insufficient insulin secretion, reduced insulin action, with carbohydrate, fat, and protein metabolism disturbances. Three types of DM include Type 1 diabetes mellitus (T1DM), Type 2 diabetes mellitus (T2DM), and gestational diabetes mellitus (GDM). 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 DM may experience fatigue, blurred vision, gain or loss of weight gain or loss, and conditions such as foot/leg wound, virginites, urinary tract infection, numbness of extremities and vision changes (Prajapati, 2019).

According to Pippitt et al. (2016), an initial diagnosis occurs when fasting plasma glucose (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. A yearly screening is recommended if the aforementioned result is borderline (Garber et al., 2019). There are several treatments for T2DM management. Most patients with T2DM 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 categorised 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).

Maintaining good foot hygiene is essential to reduce 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. Besides 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 most of the patients with diabetes (81.5%) never trimmed their toenails regularly (Akhtar et al., 2018).

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). Other similar findings included a study conducted by Azmi et al. (2020) that reported 42.2% wore broad, round shoes; 4.7% wore pointed shoes, and 66.2% wore flip-flops while Ahmad Saroni et al. (2017) emphasised the need to break into new shoes to prevent foot injury.

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 (Akhtar 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. 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). About 70% of the participants never put their feet near the fire, 63.3% never used a radiator (Alsaleh et al., 2021). A cross-sectional study carried out by Mehmood et al. (2018) with 488 participants in Dubai also reported the practice of foot care was found to be poor 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 behaviours among 72 participants in Indonesia are at a poor level, with 86.4 % of participants had poor foot care practice and the remaining 12.3 % had moderate practice. Kamaru Zaman et al. (2018) reported 49.4% of the 81 participants 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 foot care behaviour, and only one-third of them had poor foot care levels. Another study by Seid and Tsige (2015) showed that more than half of the study participants in Ethiopia had good level foot care behaviour.

With the increasing prevalence of T2DM across the world, the inconsistent findings from previous studies and lack of recent data especially from the Southeast Asia region, there is a need to find out more about the foot care behaviour among patients with diabetes in Malaysia. We aimed to assess the foot care behaviour among the patients with T2DM in the outpatient clinic in one of the public hospitals in Malaysia.

3.0 Methodology

3.1 Study design, study setting, and population

This study was a cross-sectional survey conducted among the patients with T2DM who were attending the Endocrine Clinic, Hospital Tengku Ampuan Rahimah Klang in Malaysia.

The inclusion criteria included patients aged 18 years old and above and patients who agreed to give consent for participation. Patients were excluded if they were illiterate or patients with diabetes complications such as post cerebrovascular accident and DFU who were unable to perform self-care.

3.2 Sample size

The total population was 420 patients with T2DM. Using the Raosoft sample size calculation with 95% of confidence level and 5% of margin error, the sample needed in this study was 201 participants. We included a 20% attrition rate and the final sample size needed was 242 participants.

3.3 Research instruments

A self-administered, bilingual (English and Malay) questionnaire was used in this study. We used the Nottingham Assessment of Functional Footcare (NAFF) which is developed by Lincoln et al. (2007) with a written permission from the original author to use this instrument. For the Malay

version, we had one independent translator who performed forward translation and another independent translator for the back-translation. The questionnaire consists of two parts: Part 1 for sociodemographic data and Part 2 for 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 between 1 April 2021 and 31 July 2021. Eligible participants were recruited using the convenience sampling method in the study setting. Consented participants were given a set of self-administered questionnaires to answer. It took the participants 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 of the participants.

3.6 Data analysis

Data were analysed using the Statistical Package for Social Science (SPSS) version 25. All data was sorted, organised and arranged according to the identification number, which was tagged at the left upper side of each set of questionnaire to avoid double-entry of the data, and allow a quick reference if needed.

The descriptive analyses such as frequency and percentage were used for gender, age, ethnicity, marital status, duration of DM, educational level, and foot care behaviour: foot hygiene, footwear, and general foot care practice. The Chi-square and Fisher's Exact Test were used to answer the research question, to determine the association between sociodemographic data with the level of foot care behaviour.

4.0 Results

4.1 Demographic characteristics

In this study, majority of the participants aged between 40 to 60 years old (51.4%) with more female (57.9%) than male participants. Most of the participant were Malay (45.5%) and married (73.6%). More than a quarter of the participant had T2DM for six to ten years (30.6%) and attended secondary school (52.1%). Table 1 summarises the demographic characteristic of this study.

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

Variables	n	%
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

Data are presented in frequency (n) and percentage (%)

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 of participants (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 a 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 ($\chi^2=5.764$, $P=0.124$) and level of foot care behavior, race ($\chi^2=5.955$, $P=0.114$), marital status ($\chi^2=0.59$, $P=0.775$) with very weak associated (0.046), and duration of Diabetes ($\chi^2=1.326$, $P=0.857$) 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 ($\chi^2=16.148$, $P=0.001$). 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 (χ^2)	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	5.764	0.124	0.154
21 – 40 years	40	40			
41 – 60 years	46	79			
> 60 years	16	12			
Race					
Malay	52	58	5.955	0.114	0.157
Chinese	6	19			
Indian	46	53			
Other	2	6			
Marital status					
Single	17	23	0.509	0.775	0.046
Married	80	98			
Widow/widower	9	15			
Duration of disease					
< 5 years	24	26	1.326	0.857	0.074
6 – 10 years	32	42			
11 – 15 years	27	32			
16 – 20 years	13	23			
> 20 years	10	13			
Education level					
No formal education	2	6	16.14	0.001	0.258
Primary school	8	17			
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 behaviour and can reduce the risk of foot complications. In this study, more than half of the respondents had a low level of foot care behaviour. This result was consistent with studies conducted in North Iran, and Bangalore with majority of their subjects had a low level of foot care behaviour (Pourkazemi et al., 2020, Manjunath & Nandini, 2020). Another study by Sen et al. (2019) also showed half of the participants had low footcare behaviour. 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 behaviour among type 2 diabetes patients in long term.

Contrarily, Yilmaz et al. (2019) mentioned that most study participants had moderate footcare behaviour, 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 behaviour. A study in Indonesia by Sari et al. (2020) mentioned that half of the study subjects were concerned about foot care behaviour which indicated a high level of foot care behaviour. In Malaysia, Kamaru Zaman et al. (2018) found that half of the study participants in Kuala Lumpur had fair and good foot care behaviour.

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 ($CI=6.35$). Miiikkola 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 Devarajoo and 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 behaviour 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 behaviour. 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 behaviour among patients the T2DM. 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 behaviour.

There were several recommendations following this study. First, a more rigorous study design may be conducted to explore the relationship between diabetic foot education and diabetic foot care behaviour to look at its effectiveness. 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 behaviour because this condition was at an alarming rate in a health setting and country. A review of the latest guidelines and education programme amongst the health care providers may be needed to provide the effective and comprehensive health education to patients and their care givers.

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 centre that may not be able to be generalised 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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Article Contribution to Related Field of Study

Our findings provide the overview of the latest diabetic foot care behaviour in our sample population. It gives the policymakers an insight on each components of the foot care behaviour among patients with T2DM, and subsequently effective strategies may be develop to improve the overall diabetic foot care behaviour amongst the patients which may help to prevent diabetic foot complications and improve their quality of life living with the chronic disease.

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