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Kertas Asli/*Original Articles*

Foot Sensation Status of Malay Women with Type 2 Diabetes Mellitus

(Status Deria Rasa Kaki Wanita Melayu yang Menghidapi Diabetes Mellitus Jenis 2)

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ABSTRACT

This study aimed to identify the foot sensory status of Malay women with type 2 diabetes mellitus and to determine its relation with: demographic factors, glycated haemoglobin level in plasma, and body mass index. A cross-sectional study was conducted on 71 Malay women with type 2 diabetes mellitus who attend three health clinics in Hulu Langat District, Selangor. Foot sensation was assessed using the Semmes-Weinstein Monofilament 5.07 in nine locations on the plantar and dorsal of the feet. Loss of protective sensation was defined as inability to sense the monofilament in one or more sites of either foot. This study found that 56.3% of women had loss of protective sensation, with common sites being the heel, fifth metatarsal head, lateral mid-foot and little toe. Duration of diabetes mellitus were significantly related to foot sensation. The age, HbA_{1C} level and body mass index did not show any significant correlation. Loss of protective sensation may lead to serious foot complication and therefore early screening involving multidisciplinary team is essential for prevention.

Keywords: Foot sensation; neuropathy; loss of protective sensation; diabetes mellitus; Malay women

ABSTRAK

Kajian ini bertujuan untuk mengenal pasti status deria rasa kaki wanita Melayu yang menghidapi diabetes mellitus jenis 2 dan menentukan hubungannya dengan faktor demografik, aras hemoglobin glikated dalam plasma serta indeks jisim badan. Kajian keratan rentas ini dijalankan ke atas 71 orang wanita Melayu yang menghidapi diabetes mellitus jenis 2 dan mendapatkan rawatan di tiga klinik kesihatan di Daerah Hulu Langat, Selangor. Deria rasa pada kaki dinilai menggunakan Semmes-Weinstein Monofilament 5.07 pada sembilan lokasi pada bahagian plantar dan dorsal kaki. Kehilangan deria rasa perlindungan ditakrif sebagai ketidakupayaan merasa monofilamen pada satu atau lebih tempat pada kaki. Kajian ini mendapati 56.3% wanita kehilangan deria rasa, dimana tempat yang paling kerap adalah pada tumit, kepala metatarsal ke-5, pertengahan kaki bahagian lateral dan jari kaki kecil. Tempoh menghidapi diabetes mellitus mempunyai perkaitan secara signifikan dengan deria rasa kaki. Namun begitu, umur, aras HbA_{1C} dan indeks jisim badan tidak menunjukkan sebarang korelasi. Kehilangan deria rasa perlindungan boleh membawa kepada komplikasi kaki yang serius. Dengan itu, penyaringan awal melibatkan kumpulan multidisiplin adalah diperlukan sebagai pencegahan.

Kata kunci: Deria rasa kaki; neuropati; kehilangan deria rasa perlindungan; diabetes mellitus; wanita Melayu

INTRODUCTION

Diabetes Mellitus (DM) is an increasing epidemic disease in Malaysia (Chan et al. 2007) and peripheral neuropathy had been reported as its most common chronic complication (Mastura et al. 2008; Bruce & Young 2008). The prevalance of diabetic peripheral neuropathy in Malaysia ranges from 19.0% to 50.7% (Mastura et al. 2008; Mafauzy 2006; Mimi et al. 2003). Loss of protective sensation (LOPS) increases the risk of other diabetes-related foot problems such as foot deformities, muscle weakness, ulcers and lower-limb amputation (Bruce & Young 2008).

The process of neuropathy is irreversible (Unger 2005). Therefore, early detection and intervention is the only means by which to prevent the adverse effects of neuropathy. The Semmes-Weinstein Monofilament (SWM) 5.07 has been used clinically to screen for foot sensation. It has been reported that, after identifying the areas of the feet at high risk of trauma, the practice of intensive foot care, including foot education on the choice of proper shoes, daily skin inspection and treatment for infection, ulcers and peripheral vascular disease, may prevent up to 90% of amputation (Smieja et al. 1999).

This study uses the SWM 5.07 to determine the foot sensation status of Malay women with type 2 DM in Malaysia and to correlate that status with the following factors: age, duration of DM, glycated haemoglobin (HbA_{1C}) level and body mass index (BMI). The findings present a general picture of the foot sensation status of female diabetic patients and the associated factos in order to increse awareness among the public and to encourage general practitioners and other health careworker to practise comprehensive diabetes-related foot examinations on regular basis.

MATERIALS AND METHODS

This cross-sectional study was carried out under the main study entitled, 'Sexual Function of Malay Women with Type 2 DM, which had received research approval from the Institute for Health Behavioural Research (IHBR) and ethical approval from the Medical Research Ethic Committee (NMRR-08-900-2055). All Malay women aged 20-60 years, diagnosed with type 2 DM and receiving treatment from three community health clinics at Bangi, Kajang and Beranang in Hulu Langat District, Selangor were invited to participate. The study period was from 1 May 2009 to 30 August 2009. Excluded from the study were women with Type 1 DM, those diagnosed with chronic or terminal disease (except hypertension), those under treatment for psychiatric disorders and pregnant or two months post partum.

Each participant was given a detailed explanation regarding the research and was asked to provide informed written consent before participating in the research. Demographic data such as age, occupation, education level, duration of DM and presence of other illness were obtained from participants. Blood samples were obtained and sent to a laboratory to determine the level of HbA_{1C}. The BMI was calculated based on each participant's height and weight.

The foot sensation was assessed using the SWM 5.07. The monofilament was applied to nine different sites on each foot at right angles to the skin with the patients unable to see their feet as show in Figure 1. The subject was asked to answer "yes" when the felt something (Nather et al. 2009). Loss of protective sensation was defined as failure to feel the monofilament on one or more sites of either foot (Byoko et al. 2006).

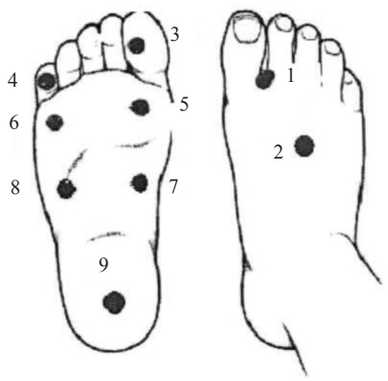

FIGURE 1. Nine locations on each foot for detection of loss of protective sensation by using Semmes-Weinstein Monofilament 5.07

Data obtained were analysed using the SPSS statistical software version 16 (SPSS Inc., Chicago, Illinois, United States). Socio-demographic data, glycaemic control status, BMI and foot sensation status were discussed descriptively. Spearman's rank test was used to determine the correlation between foot sensation status and the factors of age, duration of DM, HbA_{1C} level and BMI.

RESULTS

Out of 300 patients contacted, only 71 agreed to participate in the research. The low response rate was due to several reasons: some telephone numbers were uncontactable; some of the women were busy with work or children; some husbands disapproved; and some women were unable to participate because of lack of transportation or ill health.

Table 1 shows total sensory lost and Malay women's socio-demographic characteristics of age, occupation, education status, duration of DM, HbA_{1C} level and BMI. The total Malay women that having total sensory loss is 14 people. Out of 14, only 1 person below age 40 which represent 7.1% is experience total sensory loss and the remaining 92.9% is for Malay women whose age more than 40 years old. Percentage of working Malay women that experience total sensory loss is 71.4% which in numbered represent as much as 10 people and the rest are for those who are not working which is 4 people or 28.6%. Education level for those who are below or same as SPM level are 85.7% while above SPM level 14.3%. For duration of having DM, Malay women who experience less than 10 years and more than 10 years are equally percentage. Glycated haemoglobin (HbA_{1C}), test result under good and satisfactory are 14.3% while poor is 85.7% for Malay women experience total sensory loss. BMI also being measured which is all participant include in overweight and obesity.

TABLE 1. Total sensory loss according to socio-demographic characteristics

Characteristics	Subject (n = 14) n (%)	p-value
Age		
< 40	1 (7.1)	0.142
> 40	13 (92.9)	
Occupation		
Housewife	4 (28.6)	0.355
Working	10 (71.4)	
Education level		
< = SPM	12 (85.7)	0.502
> SPM	2 (14.3)	
Duration of DM		
< 10 years	7 (50)	0.001
> 10 years	7 (50)	
HbA_{1c}		
Good & Satisfactory	2 (14.3)	0.286
Poor	12 (85.7)	
BMI		
Normal	0 (0)	0.155
Overweight & Obese	14 (100)	

Foot sensation according to each tested site is shown in Table 2. The heel was the location that was the most insensate to the monofilament (31.7%), followed by the fifth metatarsal head (16.1%), lateral mid-foot (12.4%), little toe (9.9%), great toe (7.5%) and dorsal mid-foot (7.5%). The medial mid-foot was the most unlikely site to experience a sensory problem.

TABLE 2. Foot sensation status according to each location

Location that unable to feel monofilament (number refering to Table 1)	Number of foot losing protective sensation, n (%)
Dorsal	
Base between great toe and second toe (1)	9 (5.6)
Dorsal mid-foot (2)	12 (7.5)
Plantar	
Great toe (3)	12 (7.5)
Little toe (4)	16 (9.9)
1st metatarsal head (5)	10 (6.2)
5th metatarsal head (6)	26 (16.1)
Medial mid-foot (7)	5 (3.1)
Lateral mid-foot (8)	20 (12.4)
Heel (9)	51 (31.7)

Spearman's rank test was used to determine the correlation between foot sensation status and socio-demographic factors (age and duration of DM), HbA_{1C} level and BMI. The test results are summarized in Table 3. This study suggests that increase in duration of DM were significantly associated with poorer foot sensation status. However, age, HbA_{1C} level and BMI were not significantly correlated with foot sensation status.

TABLE 3. Correlation between foot sensation status (total sensory loss) and associated factors

Variables	Foot total sensory loss	
	rho	p-value
Age	0.222	0.063
Duration of DM	0.326	0.005
HbA_{1C}	0.153	0.204
BMI	0.058	0.632

DISCUSSION

Generally, the diabetic control in our subjects was poor. It was manifested by poor glycaemic control, being overweight or obese, as well as by the presence of reduced foot sensation. This showed that participants were at high risk of developing various diabetic complications, including neuropathy.

None of our subjects had ever undergone any foot sensation examination before. However, more than half of our subjects were found to have LOPS, suggesting a probable underestimation of neuropathy. Previous studies have shown that about that about 14.4% to 37% of diabetic patients may have neuropathy that has been missed by the doctor in routine diabetic follow-ups (Ahmed et al. 209; Herman & Kennedy 2005).

All the testing sites are frequent locations for foot ulcers in diabetic patients (Smieja et al. 1999). The heel and metatarsal heads are weight-bearing with bony protrusions. Repetitive pressure when walking causes the formation of calluses. This leads to reduced sensation and ulceration. The loss of protective sensation at the lateral mid-foot may suggest unsuitable or ill-fitting shoes and ischemic pressure necrosis (Levin 2002).

Neuropathy in diabetic patients decreases quality of life and is the main cause of morbidity and mortality, and there are also increased medical costs (Nather et al. 2008, Booya et al. 2005). A study by Booya et al. (2005) associates neuropathy with male gender, age, glycaemic control and duration of DM. Morkid et al. (2010) identifies higher age, lower socioeconomic status, longer duration of DM, treatment with insulin and poor glycaemic control as significant risk factors for neuropathy. Meanwhile, other studies identify only duration of DM and age as contributory factors (Ashok et al. 2002).

This study agrees with past studies that duration of DM significantly correlate with foot sensation status (Mimi et al. 2003; Booya et al. 2005; Ashok et al. 2002), that is to say, that with higher age and longer duration of DM, more sites in the foot will lose protective sensation. Thus, the risk of neuropathy increases. Biological and chemical changes during the aging process such as increases in advanced glycosylation end-products (AGEs), defects in the polyol pathway, nerve vascular alterations and impaired resistance to oxidative stress may account for the relationships between age and diabetic neuropathy (Belmin &Valensi 1996).

However, this study found that glycaemic control is not associated with LOPS in diabetic patients, which is in contrast with the findings of some studies (Bruce & Young 2008; Booya et al. 2005; Morkid et al. 2010). Nevertheless, this finding supports several studies both in and out of this country (Mimi et al. 2003; Herman & Kennedy 2005; Basit 2005). A cross-sectional study which measure the HbA_{1C} level only once may mask the correlation with neuropathy (Herman & Kennedy 2005). A prospective study usually has greater power to ascertain the relationship (Reiber et al. 2002).

This study also showed that reduced foot sensation is not associated with BMI. The results agrees with the findings of one study (Ugoya et al. 2008), but is in disagreement with those of another (Tomic et al. 2003). However, the latter study explains that neuropathy may not be the direct result of obesity, but the consequence of interaction of various risk factors, both genetic and environmental, including obesity (Tomic et al. 2003).

Diabetes mellitus is a costly disease. Each year, huge medical expenses are incurred by the government in the treatment of diabetic complications and also a

great burden for the patients (Shobhana et al. 2000). An urgent effort is therefore needed to reduce the incidences of diabetic complications before the associated medical costs overburden the country's health care budget. For more effective diabetic management, the emphasis should be placed on primary care. A multidisciplinary team should focus on health promotion, chronic/ongoing disease management and illness prevention (Sadur et al. 1999). Sadur and colleagues (1999) discovered that multidisciplinary team consisting of a diabetes nurse educator, a psychologist, a nutritionist, and a pharmacist had improved glycaemic control, self-efficacy, and patient satisfaction and resulted in a reduction in health care utilization.

It should be noted that some limitations have been identified in this study. First, the cross-sectional research design has limited the investigation of the relationship between various factors and foot sensation. This was because in the cross-sectional study, the HbA_{1C} level was measured only once and therefore did not represent long-term glycaemic control. Second, the study population was small and involved only Malay women. Thus, it cannot be said to represent the true situation in Malaysia.

CONCLUSION

In conclusion, the study showed that foot sensation status was generally unsatisfactory in Malay women with type 2 diabetes. Increase in age and increase in duration of DM were found to be significantly correlated with reduction in foot sensation. Our findings should serve as a useful reminder to all health care professionals of the importance of regular foot care and screening for diabetics. More intensive foot care and foot examinations should be incorporated into diabetic treatment programme.

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