

Foot problems in Māori with diabetes

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Abstract

Aim The prevalence of diabetes and its associated manifestations is higher in New Zealand Māori than New Zealand Europeans. There is no current evidence regarding podiatric clinical characteristics of Māori with diabetes. The aim of this study was to determine the clinical and foot characteristics of Māori with diabetes using a podiatry-specific assessment tool.

Method This study used a cross-sectional design. Participants with diabetes were recruited from two Māori Primary Health Organisations. Podiatric-specific characteristics (vascular, neurological and musculoskeletal) were recorded. Patient demographics and general medical conditions were also recorded.

Results Fifty-three participants were recruited and displayed risk factors for diabetes-related complications (mean disease duration 12 years, mean HbA1c 8.3%) including 49% of participants with hypertension. Podiatric-specific characteristics revealed unremarkable neurovascular results. However, many participants presented with pre-ulcerative lesions and current pedal ulceration (53% and 8% respectively). Although many participants had good foot-care knowledge (>85%), a modified classification tool of foot risk status determined that a high percentage of participants required regular podiatric management and screening (60%).

Conclusion Despite this population living with a chronic condition for more than 10 years and displaying poor long-term glycaemic control, there was no evidence of microvascular or macrovascular complications in the lower limb. However, there was a high prevalence of pre-ulcerative lesions which unmonitored and undetected may predispose the foot to ulceration. The detection of current ulceration in this study alongside other risk factors for diabetes-related complications necessitates the need for appropriate podiatric screening and podiatry management.

Diabetes Mellitus (DM) presents as a global economic burden.¹ In New Zealand, the prevalence for undiagnosed DM in Māori is higher than that for non-Māori, presenting as an opportunity to reduce significant mortality and morbidity in this population.²

Complications arising from DM account for 20% of all deaths among Māori as compared to 4% in other New Zealanders.³ In one study, a high proportion of ulceration and amputation as a consequence of diabetes was observed in Māori.⁴ A further study reports that Māori were less likely to have on-going DM related-care due to poor perception of risk.⁵ Therefore for Māori, non-participation in 'ongoing care' can intensify the problem due to the inability to detect or manage signs or symptoms of diabetes-related complications.⁶

When undetected and untreated, the effect of foot problems in people with DM can progress rapidly and lead to morbidity and mortality from complications such as

ulceration, gangrene and amputation.^{3,7} Appropriate screening ensures effective targeting of at-risk populations, early intervention, and surveillance of those detected with significant pathology.⁸⁻⁹

Previous studies have reported on the major contributing factors to diabetic foot pathology, which often occurs in conjunction with other organ complications.^{8,10-11} Of these, neuropathy and mechanical stress are the key factors in predisposing the foot to increased plantar pressures effectively resulting in ulceration.^{10,12-13} Furthermore, peripheral arterial disease, infection, patient disability, maladaptive self-care behaviour and access barriers consequently place the foot at higher risk of a major complication.^{7,10,14}

The national introduction of the 'Get Checked Programme' provided the first opportunity to gather information pertaining to glycaemic control, lifestyle behaviour, diabetes-related cardiovascular disease, renal disease, retinal screening, and foot screening data.³ However, the programme was not designed to identify the level of susceptibility of risk to the foot.

The need to undertake an assessment that includes the identification of the level of risk was therefore required.³ The assessment should also indicate frequency of monitoring and classification of risk status, in order to implement effective management plans.

Therefore, whilst it is clear that Māori are more significantly at risk of diabetes-related complications, data regarding characteristics and management for foot pathology is limited in this population.

The aim of this study was to select Māori with Type 2 diabetes, who had either not received an annual 'Get Checked' review or who presented with features of an at risk foot; and through the use a podiatric diabetic assessment tool, determine clinical and foot characteristics.

Methods

Study design—This study used a cross-sectional design and was undertaken in the Waitemata district, Auckland, New Zealand. The study was conducted between 2007 and 2008. Ethical approval was obtained from the Auckland University of Technology University ethics committee (07/198) for review prior to submitting to Northern Y ethics committee (NTY/05/08/055).

Participants were recruited from two Māori Primary Health Organisations (PHOs) and identified by a data search using Medtech-32. A query build function was set up to include participants with T2DM; ≥18 years old; Māori; who had not received a national diabetes assessment for >12 months;³ had undetected pedal pulses, absence of sensation, previous history of peripheral vascular disease, or ulceration as determined by the 'Get Checked' Programme.³

Two research investigators accessed electronic patient records. One investigator was responsible for initial contact with the participants via telephone to explain the aim of the study. Informed consent was obtained from all participants.

Exclusion criteria included those who were not registered with the PHO; who had a below knee amputation or who attended regular podiatry appointments. Two experienced podiatric practitioners involved in working with Māori undertook all podiatric assessments. To ensure consistency between the two practitioners, each practitioner undertook a single training session prior to data collection.

Demographic characteristics including age (years), gender, body mass index (kg/m²), disease duration (years) and medical conditions were recorded. Smoking status was also reported. Perception of risk, past history of foot or leg ulceration/amputation, past history of lower extremity revascularisation were also recorded.

Clinical data including; serum glycated haemoglobin levels HbA1c and HbA1c >8% over a 6-month period; pharmacological management for DM (insulin, and oral hypoglycaemic agents), as well as regular (daily) and irregular (every other day) self-monitoring of blood glucose levels were collected. Foot risk status was recorded using a modified classification based on a previously published classification system.¹⁰

The podiatric diabetic assessment tool included a neurovascular, musculoskeletal and education component. The vascular assessment included a history of intermittent claudication.¹⁵ Pedal pulse assessment, visual identification of skin integrity, and ankle-brachial index (ABI) were obtained.

The neurological assessment was based on the neuropathy signs (NDS) and symptom scoring system (NSS).¹⁶ The musculoskeletal assessment included the evaluation for limited joint mobility in the hands¹⁷ and feet. Lower extremity nail and skin conditions were also recorded.¹⁸

Participants were asked to report on self-care behaviours and self-knowledge which included daily foot inspection, application of skin moisturisers, avoiding situations of risk (avoiding heaters or walking barefoot); as well as understanding the benefits of good glycaemic control, and foot problems associated with neuropathy.^{3,8,19}

Participant's responses were recorded as either 'yes' or 'no', for example, 'yes' if the patient had a level of understanding and if they practiced self-care behaviours regularly.

Statistical analyses—Age, BMI, disease duration, HbA1c, ABI, NSS and NDS were described as a mean (SD). All other demographic, clinical, general medical and foot education characteristic scores were described as percentages (%). Data was analysed using SPSS version 17.0 software.

Results

Fifty-three Māori participants with diabetes had a mean (SD) age of 53.7 years (10.7 years). The cohort consisted of 47% of women. The mean duration of diabetes was 12.0 (5.2) years. The mean (SD) BMI was 37.8 kg/m² (8.1). Of this cohort, 25% of participants were current smokers and 28% had a low perception of how these risk factors impact on diabetes-related complications.

Foot ulceration/amputation history was reported in 17% and 6% reported a past history of lower extremity re-vascularisation. The majority of participants were classified in category 2 or category 3 as demonstrated in Table 1. Regular and irregular self-checking of blood glucose levels were reported (46% and 41% respectively) and elevated HbA1c levels (>8%) were common amongst 42% of participants. Pharmacological management is demonstrated in Table 1.

Other risk factors for diabetes-related complications such as obesity, hypertension, dyslipidaemia and retinopathy were reported (62%, 49%, 55%, 21%). No participants were diagnosed with end-stage renal failure requiring dialysis.

Intermittent claudication was present in 11% of participants. ABI mean (SD) are reported in Table 1. The mean (SD) for the NSS was 3.2 (2.8), and NDS score was 2.0 (2.0). Dry skin featured highly (70%).

Hallux valgus (bunion) deformity was observed in 11% of participants and 30% of participants demonstrated hallux limitus. Clawing of the lesser toes was found in 38% of participants. A high number of participants presented with nail conditions (64%). Charcot foot was not observed. Many participants presented with pre-ulcerative lesions (53%) and 8% with current ulceration.

Table 1. Screening characteristics

Podiatric assessment and current management	Results
Insulin	11 [21%] n, [%]
Oral Hyperglycaemic Agents	48 [91%] n, [%]
Classification of foot risk status	n [%]
	Category 2: 19 [36%]
	Category 3: 24 [45%]
	Category 4: 6 [11%]
	Category 5: 2 [4%]
	Category 6: 2 [4%]
ABI: Right DP	1.07 (0.16) Mean (SD)
ABI: Right PT	1.12 (0.17) Mean (SD)
ABI: Left DP	1.08 (0.16) Mean (SD)
ABI: Left PT	1.12 (0.17) Mean (SD)
Achilles Tendon Reflex: Right	n [%]
Present	33 [65%]
Reinforcement	8 [15%]
Absent	10 [20%]
Achilles Tendon Reflex: Left	n [%]
Present	33 [65%]
Reinforcement	10 [20%]
Absent	8 [15%]
Biothesiometer (V): Right	19.3 (13.8) Mean (SD)
Biothesiometer (V): Right	16.2 (11.2) Mean (SD)

Diabetes-related knowledge was favourable in this cohort (98%), and positive foot care behaviour was present in 32%. Previous foot care from podiatrists (more than one year ago) had been received from 62% of the participants, whilst 4% reported previous use of a public orthotic service. Other features of the self care behaviours and knowledge are demonstrated in Table 2.

Table 2. Foot care behaviours and knowledge characteristics

Participant knowledge and foot care behaviours	Results n [%]
Smoking effects on circulation	46 [86%]
Neuropathy and foot problems	52 [98%]
Circulation and foot problems	50 [94%]
Understands the causes of amputation	51 [96%]
Use of moisturisers	51 [96%]
Drying feet after bathing	52 [98%]
Avoiding heaters and barefoot	51 [96%]
Footwear advice	51 [96%]
Understands the benefits of exercise	52 [98%]
Contacting podiatrist	51 [96%]

Discussion

Māori are over-represented in diabetes-related complications compared with New Zealand Europeans. The podiatry assessment tool in this study was used to determine clinical and foot characteristics in a selected group of Māori with diabetes. One feature of the assessment tool is screening for peripheral neuropathy.

Peripheral neuropathy is a consequence of hyperglycaemia, increasing age and progression of DM.¹⁶ We found that the majority of participants in this population did not display clinical evidence of distal symmetrical sensorimotor neuropathy as compared to a large multi-centred trial.¹⁶

Of the four signs which comprise the neuropathy disability score, loss of vibration sense featured highly although this did not affect the overall score. The inclusion criteria was designed to capture those with 'at risk' foot characteristics as determined by the 'Get Checked' initiative.³ The podiatry assessment tool is therefore useful in detecting further signs of neuropathy.

The vascular assessment included a non-invasive clinical test (ABI) to detect clinical signs of peripheral arterial disease (PAD). The current study demonstrated mean ABI readings of normal range, despite claims of that ABI assessment is impractical and nondiagnostic in people with diabetes.²⁰ Whilst having a low ABI is an independent risk factor for cardiovascular disease (<0.9), having an ABI reading of >1.3 is indicative of arterial wall calcification, a common finding in people with DM.²⁰

A small number of participants in this study complained of symptoms associated with PAD, which is consistent with other studies.²⁰ However, symptomatic pain query as well as relying on absent pedal pulses can underestimate the prevalence of PAD. More than half of the participants in this study displayed risk factors for PAD such as poor blood glucose control, dyslipidaemia and hypertension.

The musculoskeletal assessment screened for limited joint mobility. Limited joint mobility has been suggested to be a major contributing factor to increased forefoot plantar pressure.^{21,22} Hyperglycaemia contributes to collagen cross-linking and reduction in elasticity in tendons.²¹ Hence, the arch loses stability during propulsion ultimately increasing pressure particularly to the metatarsophalangeal joints.²¹ This could explain why some participants in this cohort displayed evidence of pre-ulcerative lesions.

A previous study has reported that when tendon and joint stiffening occurs, neuropathy is usually present.¹⁶ However, a limitation of previous studies is that they have not taken into consideration specific ethnic characteristics that may affect plantar fascia thickness and plantar pressure in the forefoot. Comparative studies on Māori with and without diabetes are required.

A modified classification of foot risk status was adapted in order to determine the level of risk in which the foot is susceptible to developing foot ulceration.^{10,19} A high number of participants in the current study displayed clinical evidence that would support regular review from their podiatrist for management and surveillance of foot risk factors.

There are no current guidelines for podiatrists or referrers to podiatrists in New Zealand. Therefore, the modified classification used in the study is useful for determining management plans that include primary and secondary referral.

The modified classification fits with other studies, although the categorisation used is more sensitively designed for the likely health issues arising from within specific populations.¹⁰ In addition, the modified classification builds on and refines the approaches already identified as being effective in this field. To that extent, the modified classification used in our study is more detailed and has the added benefit of targeting risk factors efficiently, permitting even more appropriate referral.

The classification builds upon the information gathered from the podiatric diabetic assessment tool and participants are able to move between risk depending on their collective assessment. Each category is then deliberate in its attempt to prompt the clinician to manage the patient accordingly.¹⁹

Previous studies indicate the success of podiatry-specific foot education programmes in diabetes.⁸⁻⁹ Foot-care behaviour was positively modified in 70% of participants with established neuropathy contributing to the reduction of foot ulcerations significantly.⁹ Furthermore, previous work has reported that foot care behaviours reduced the incidence of callosities in a podiatrist led group as compared to a control group, reducing plantar pressure.⁸

The programme used in the current study could offer support as to reasons why the study population did not attend with major complications such as neuropathic ulceration indicating the benefits of foot care education. However, in order to sustain positive behaviour, podiatry led-programmes need to be sustainable and implemented before or as close as possible to the diagnosis of neuropathy in order to achieve clinical benefits.⁸⁻⁹

We found a small number of the current population had an overall low perception of their risk of diabetes-related complications, although almost all participants had good general knowledge about diabetes and its associated complications which is partly in agreement with an earlier study.⁵ We also found that many of the participants in this study had visited a podiatrist more than a year prior to the study.

This result may be largely due to the podiatrist's long history with both medical centres, and may not be representative of regional podiatry services. However, the current results are encouraging and indicate that previous education may be significant in influencing foot care behaviour.

A high number of people in this study had never smoked cigarettes, or had ceased smoking cigarettes (more than one year abstinence). Our findings are similar to that of a previous South Auckland survey, where participants with diagnosed diabetes also reported low cigarette smoking rates.⁵

These findings conflict with another study, which report a high prevalence rate of smoking among Māori as compared to non-Māori (35% and 13% respectively) with diabetes.²³ However, there is no data reflecting current cessation rates between these two groups in people without diabetes. The findings from the current study deserve further exploration and offer encouraging results.

There are several limitations to this study that warrant discussion. The current study had no comparison or control groups so we do not know if the podiatry program reduced the impact of diabetes-related complications. Future randomised longitudinal intervention studies are warranted to address this as well as compare Māori and non-Māori utilising this programme.

The modified classification tool and self-reported knowledge questions used in the current study have not been assessed in terms of validity or reliability in the current population. The tool was developed by clinicians to incorporate foot-related problems within the multidisciplinary diabetes team.

Although the assessment tool was designed to be consistent with Māori aspirations and culturally acceptable for Māori,¹⁹ future work is required to evaluate the tool that includes reliability, content, construct and face validity. Questions regarding impaired mobility were self-reported, which may lead to recall bias. There were no specific measures used to determine functional impairment and disability.

The size and selection of the population was limited compared to other studies.⁸⁻⁹ Only those registered with either medical centre were invited due to access to and recording and storage of electronic data. Participants with previous amputations were not recruited because their data may skew results, specifically neurological and musculoskeletal data.

The size of the cohort may be attributed to Māori being suspicious of participatory research.²⁴ For future studies, effective partnership between researchers and Māori communities are recommended. Regular Hui (meetings) at the medical centres and local marae need to occur from the inception of the idea, through to the conclusion of the study.

Conclusion

The aim of this study was to select Māori with Type 2 diabetes, who had either not received an annual 'Get Checked' review or who presented with features of an at risk foot; and through the use a podiatric diabetic assessment tool, determine clinical and foot characteristics.

The current study has highlighted low prevalence of vascular and neurological foot characteristics in this sample of Māori people with Type 2 diabetes. However, there was an increased occurrence of pre-ulcerative lesions in this group indicating a need for podiatric intervention. We also found participants in this study had good general knowledge of diabetes and diabetes-related complications yet the validity of this characteristic remains unclear.

Overall, the current study demonstrates that there could be a place for standardised podiatry assessment in New Zealand to monitor and review people with Type 2 diabetes. Future studies that include randomised controlled clinical trials are needed to evaluate the clinical effectiveness of diabetic foot-related podiatry programs in clinical practice.

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