

# The role of appropriate footwear in the management of diabetic foot: Perspective of clinicians in a low resource setting

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## ABSTRACT

**Background:** The use of appropriate footwear among patients with diabetes mellitus and those with diabetic foot problems has been documented to play a vital role in the prevention and treatment of the established foot disease. However, there is a paucity of literature on the role of clinicians in ensuring appropriate footwear among patients with diabetes mellitus. This paper explores current practice in the use of appropriate footwear in patients with diabetes mellitus among clinicians in Kaduna state, Nigeria.

**Materials and Methods:** A self-administered structured questionnaire was developed. The questionnaire was divided into two sections: demographic (clinical area of specialization, number of years in practice) and footwear questionnaire. The footwear questionnaire focused on three themes: diabetic foot problems encountered, type of footwear worn, and the role of footwear in the prevention of diabetic foot complications. Data were processed and analyzed using Microsoft Excel 2007.

**Results:** Almost all the participants, 41 (91%), reported that foot ulcers could be related to inappropriate footwear. Most participants, 37 (82%), reported that ill-fitting footwear could be a major problem that leads to amputation. The shoe type reported to be most frequently worn by men were sandals (35%), slippers (26%), and half shoes (17%). The three commonest shoe types that women were reported to wear were slippers (45%), sandals (24%), and half shoes (18%).

**Conclusion:** This study shows that the use of appropriate footwear in the prevention of diabetic foot complications is suboptimal. It is important that healthcare professionals support and stimulate research in establishing a diabetic footwear program.

**Key words:** Clinicians, diabetes, foot complications, footwear

## Introduction

Lower limb complications in diabetes mellitus are a frequent and seriously disabling condition.<sup>[1,2]</sup> Diabetic foot syndrome is one of the most devastating complication

affecting both the quality of life and health care utilization.<sup>[3-5]</sup> It is the leading cause of lower limb amputation, generally preceded by foot ulcers and gangrene. Foot ulceration may occur in up to 15% of diabetic patients during their lifetime and about 15-25% of people with a foot ulcer will require an amputation.<sup>[6-8]</sup> In addition to the morbidity, diabetic foot complications are associated with high mortality; 50% will die within 5 years of an initial major amputation.<sup>[4,8,9]</sup>

The major risk factors for diabetic foot complications are peripheral neuropathy, peripheral vascular disease, and foot deformity. However, inadequate or inappropriate footwear is also thought to be an important contributor to these complications.<sup>[10,11]</sup> Ill-fitting footwear is a common trigger for foot ulceration, as it exposes the patient to the direct effects of friction and/or irritation as well as indirect damage because of inappropriate foot protection. Inappropriate footwear causing increased mechanical

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stress at the plantar and dorsal surfaces of the foot has been reported as the most common cause of foot ulceration in patients with diabetes.<sup>[12,13]</sup> Footwear should be designed to relieve pressure areas, reduce shock, and shear forces and be able to accommodate deformities by supporting and stabilizing them. It is necessary that shoes fit for both size and shape.<sup>[6,14]</sup> When footwear is fitted properly, it can reduce high pressure areas and hence reduce callus formation and the threat of ulcer formation. It will also fulfill its function as a barrier to the environment.<sup>[6]</sup>

Diabetic foot complications and amputations persist despite the availability of preventive interventions.<sup>[3]</sup> The International Working Group on the Diabetic Foot has published recommendation for appropriate choice of footwear that may reduce the risk of foot ulceration and amputations. These guidelines emphasize that appropriate footwear is an important cornerstone in the care of patients with diabetes mellitus.<sup>[14]</sup> There is a paucity of literature on the role of clinicians in ensuring appropriate footwear among diabetics in Nigeria and indeed sub-Saharan Africa. Given the need for a common outcome in health care delivery globally, this article explores current practice in the use of appropriate therapeutic footwear in patients with diabetes mellitus among clinicians.

## Materials and Methods

A cross-sectional descriptive study was conducted in Kaduna, (the capital of Kaduna state, north central Nigeria) during the period January through March 2013. All clinicians involved in the management of the diabetic foot and its complications were invited to participate in the study. The study was approved by the research ethics committee at the Ministry of Health, Kaduna State and at Ahmadu Bello University Teaching Hospital, Zaria, Nigeria. Participants at the beginning of the study were given information on the nature of the survey, the participants' right to withdraw from the study at any time, and confidentiality of personal data. In order to maintain confidentiality, questionnaires were made anonymous.

A self-administered structured questionnaire was developed. The questionnaire was divided into two sections: Demographic (clinical area of specialization, number of years in practice) and footwear questionnaire. The footwear questionnaire focused on three themes: Diabetic foot problems encountered, type of footwear worn, and the role of footwear in the prevention of diabetic foot complications. The questionnaire included a range of open-ended questions as well as closed questions with

the answer options as true or false. Data were processed and analyzed using Microsoft Excel 2007. Simple descriptive statistics were used (frequency with percentage distribution for categorized variables).

## Results

Out of the 60 clinicians surveyed, 45 returned the questionnaire, giving a response rate of 75%. A total of 30 (67%) had been practicing for 6-20 years. In all, 20 (45%) were orthopedic surgeons, whereas 15 (33%) were endocrinologists [Table 1].

The frequency of diabetic foot problems encountered is shown in Table 2. Almost all the participants, 41 (91%) reported that foot ulcers could be related to inappropriate footwear. Most participants, 37 (82%) reported that ill-fitting footwear could be a major problem that leads to amputation. More than 50% of the participants had encountered patients that reported bad footwear experience.

The distribution of the commonest footwear worn by gender is shown in Figure 1. The reported shoe types most frequently worn by men were sandals (35%), slippers (26%), and half shoes (17%). The three commonest shoe types that women were reported to wear were slippers (45%), sandals (24%), and half shoes (18%). Slippers were owned by (71%) of men and women, whereas only 1% of

**Table 1: Demographic profile of participants**

Variable	Number	%
Number of years in practice		
<5	9	20
6-20	30	67
>21	6	13
Area of specialization		
General practice	10	22
Orthopedic surgery	20	45
Endocrinology	15	33

**Table 2: Participant's response to diabetic foot problems encountered and the role of footwear**

Diabetic foot problems	Yes number (%)	No number (%)
Have encountered patients that reported bad footwear experience (e.g. blisters, ulcers, etc)	27 (60)	18 (40)
Foot ulcers could be related to inappropriate footwear	41 (91)	4 (9)
Ill-fitting footwear could be a major problem that leads to foot amputation	37 (82)	8 (18)
Regular shoes are unable to accommodate the foot of many diabetes patients	31 (68)	14 (32)

men and women were reported to wear custom-made or therapeutic footwear.

A total of 81% of participants reported that their diabetic patients will be happy to use orthopedic/therapeutic footwear [Table 3]. More than 90% of the participants were of the opinion that there was no foot care or footwear program for patients with diabetes in their practice. All the participants agreed that medical specialists will benefit from education on prescription of therapeutic footwear.

## Discussion

Our study highlights the need for the use of appropriate footwear to prevent diabetic foot complications in this part of the world. Majority of the patients are reported to have foot problems and these are related to the wearing

of ill-fitting or inappropriate footwear. This contributes significantly to the susceptibility of the diabetic foot to injury and ulceration. This scenario is not different from what has been previously reported.<sup>[5,15]</sup> Foot complications from inappropriate footwear continue to exact a very high cost on society as a result of the associated disability, morbidity, and mortality.<sup>[14]</sup> Jannink and his colleagues advocate the regular use of proven therapeutic interventions (footwear) in the prevention of diabetic foot complications.<sup>[16]</sup> This should be sought and promoted because of the potential cost effectiveness and improved outcome for the patient. It has been shown that it is possible to reduce amputation rates by between 49 and 85% through a foot care strategy that combines the following: prevention, a multidisciplinary approach in the use of appropriate footwear, close monitoring, and the education of people with diabetes and healthcare professionals.<sup>[17]</sup> However, in most countries, foot care is not yet at the level of funding, organization, and professionalism that would facilitate the ready attainment of these objectives. These goals are feasible and affordable in many contexts, and it is possible to learn from settings where standards are being set.<sup>[17]</sup>

In this study, patterns of footwear were generally similar for both men and women except for the more frequent use of open toe footwear (slippers) by women. Furthermore, it was also observed that the type of footwear considered most appropriate for patients with diabetes mellitus to use (custom-molded shoes) were the least frequently worn. This finding is similar to an earlier study that revealed that provision of professional diabetic foot care services and the use of protective diabetic footwear were suboptimal in both developing and developed countries.<sup>[8]</sup> Rubbing from footwear was identified as the definite cause of 35% of foot ulcers reviewed as part of a prospective study conducted in the United Kingdom. Similarly, the follow-up of 472 patients at the Royal Prince Alfred Hospital Diabetes Centre (NSW, Australia) identified that 54% of all foot ulcers that developed in this group could be directly attributed to trauma from footwear.<sup>[7]</sup> The consistent use of appropriate footwear is important in all diabetic patients, especially those who demonstrate loss of protective sensation from peripheral neuropathy. These patients are unable to feel pressure or pains caused by inappropriate or ill-fitting shoes and are more likely to develop blisters, callus, and corns. These early complications require prompt intervention if ulceration and potential amputation are to be avoided. The simple measure of wearing appropriately fitted or prescribed footwear has been shown to significantly reduce plantar foot pressures, therefore decreasing the likelihood of developing callus and ultimately ulceration.<sup>[7]</sup>

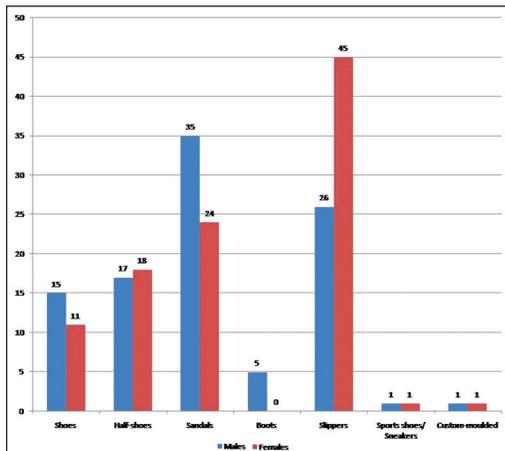


Figure 1: The distribution of footwear worn by gender

Table 3: Participants response to the role of appropriate footwear in the prevention of diabetic foot

Footwear and prevention of diabetic foot	Yes number (%)	No number (%)
Diabetic patients would be happy to use orthopedic footwear	36 (81)	9 (19)
Footwear should be regarded as an important consideration in the clinical management of foot problems	44 (97)	1 (3)
Foot care program for diabetic patients are not available in Nigeria	41 (91)	4 (9)
Footwear program for diabetic patients are not available in Nigeria	43 (95)	2 (5)
Provision of professional foot care (podiatric services) is not common in Nigeria	39 (87)	6 (13)
The risk of foot amputation may double for diabetic patients who do not obtain prescribed footwear	41 (91)	4 (9)
Doctors are unaware of orthopedic footwear makers in Nigeria	(71)	(29)
Clinicians need further education about prescription of orthopedic footwear	45 (100)	0 (0)

A total of 84% of clinicians in this study reported that their patients with diabetes mellitus will be happy to use orthopedic footwear if prescribed by their physician. Majority also agreed that footwear program for patients with diabetes in their practice were not adequate. This reinforces the need for improving footwear practices in patients with diabetes mellitus. We therefore support recommendations that all patients with diabetes should be offered foot care education aimed at improving footwear-related knowledge and practice to reduce the risk of foot complications.<sup>[6]</sup> All clinicians involved in the care of patients with diabetes need to define the level of risk for developing foot complications and thus tailor footwear advice accordingly.<sup>[7]</sup> These recommendations are quite simple and can be communicated to patients in a single encounter or over several encounters [Tables 4 and 5]. Risk stratification is determined following a basic foot assessment, which includes evaluation for the presence of peripheral neuropathy, peripheral arterial disease, and foot deformity. In addition to the foot assessment, other factors that should be considered include the patient's activity level, occupation, and level of mobility. Risk stratification should be reassessed and upgraded on a yearly basis, given the potential for progression and development of new risk factors over time.<sup>[7]</sup>

An important component of these practices is the selection of appropriate footwear.<sup>[18,19]</sup> To accommodate changes in foot structure, the footwear is designed to redistribute and reduce pressures underneath the foot and avoid mechanical stress on the dorsum of the foot. This can involve the fabrication of accommodative insoles that follow the contours of the plantar foot surface (total contact), but it can also involve the use of fully customized (therapeutic) shoes, which often also incorporate corrective elements such as arch supports, metatarsal pads and bars, or specific outsole configurations. Fully customized footwear is predominantly prescribed to patients with diabetes mellitus with a prior foot ulcer with the goal to prevent recurrence of ulceration.<sup>[13]</sup>

Several studies suggest that most patients with diabetes mellitus and especially those with a prior foot ulcer do not uniformly adhere to these recommendations and select their footwear from a variety of styles, shapes, and colors for different activities. Dissatisfaction with prescribed footwears is thought to stem from improper fit, unacceptable appearance, high cost, excessive time between ordering and receiving prescribed shoes, limited colors, styles, materials, and durability.<sup>[18]</sup> There should be extra emphasis on patient education on diabetes and awareness of avoidable complications and their prevention by following good footwear practices.<sup>[5]</sup> Patients with

**Table 4: Footwear recommendation for people with diabetes based on their risk stratification for developing foot ulceration**

Category	Foot assessment	Recommendations
Low risk	No peripheral neuropathy	Off the shelf footwear is likely to be appropriate
	No peripheral arterial disease	Encourage patients to have their feet measured and professionally fitted
	Normal foot shape and no history of amputation	Encourage patients to wear footwear that meets the criteria in Table 5
Medium risk	Peripheral neuropathy	Off the shelf footwear is likely to be appropriate
	OR peripheral arterial disease	Encourage patients to have their feet measured and professionally fitted Encourage patients to wear footwear that meets the criteria in Table 5
	Normal foot shape	Footwear must be worn at all times to protect feet from injury
High risk	No history of amputation	Fit footwear in the afternoon to ensure any dependent edema is accommodated. New footwear should be worn gradually. Check feet regularly for signs of trauma when wearing new shoes
	Abnormal foot shape, including history of amputation	Footwear assessment by an appropriately trained health professional is recommended
		Medical grade footwear and custom-molded foot orthoses will be required
Foot orthoses to be supplied prior or together with prescribed footwear		
		Footwear must be worn at all times to protect feet from injury
		Fit footwear in the afternoon to ensure any dependent edema is accommodated
		New footwear should be worn gradually
		Check feet regularly for signs of trauma when wearing new shoes

Adapted from Bergin SM *et al.*<sup>[7]</sup>

**Table 5: Shoe features that diabetic patients should be aware of when purchasing footwear**

Shoe features	Criteria for choosing appropriate footwear features
Upper part of shoe	These should be made from leather or a combination of materials (such as those used in sports shoes) with smooth inner lining and without bulky seams at the toe area
Correct length	1 cm from end of the longest toe when the patient is standing
Correct depth	Should accommodate all the toes without causing pressure
Correct width	The sides of the shoe should not bulge over the sole when worn
Low heels	Should be less or equal to 2 cm
Fastening	Adequate fastening such as laces or straps to keep the foot from sliding forward
Cushioned outer and inner soles	Approximately 0.5-1 cm thick under the forefoot
Enclosed heel	Shoes with an open back can result in injury to the skin around the heel and usually require the individual to claw their toes in order to keep them on, also increasing risk of ulceration
Soles	Should not be slippery

Adapted from Bergin SM *et al.*<sup>[7]</sup>

diabetes need consistent and ongoing education from health care providers regarding the role and importance of the regular use of footwear and the type most appropriate to their level of risk for ulceration.<sup>[7]</sup>

This study has some limitations. Participants were selected based on their willingness to participate in the study. They could thus represent clinicians who were actively involved in the care of patients with diabetes mellitus and diabetic foot complications and therefore may not reflect the spectrum of footwear practices delivered by clinicians in Kaduna state. A second weakness is the nature of the subject population — clinicians. There is a lack of perspective of the patients. For a complete view of the role of diabetic footwear in the prevention of diabetic foot complications, their opinion should be included. Future research is thus required to compare the perceptions of clinicians and patients. Additionally, prospective studies that evaluate the impact of footwear practices on outcomes such as neuropathy, foot ulcers, and amputations would further help to determine the potential for interventions to improve practice and reduce complications.<sup>[6]</sup> To further obtain valid data on the role of appropriate footwear in patients with diabetes mellitus, a comparative study of the type of footwear in patients that have had surgeries and patients that have not had surgical intervention will be important. We also believe that publication of these findings will serve as a catalyst for further studies in the subject area, where clinicians and researchers can evaluate the extent to which appropriate practices are being followed in their setting.

## Conclusion

This study demonstrates that the use of appropriate footwear in the prevention of diabetic foot complications is suboptimal. It is important that healthcare professionals support and stimulate research in establishing a diabetic footwear program in Kaduna state. Accurate data collection from multicenter studies will assist health policy decision makers to allocate resources efficiently to a state footwear program. This will lead to improved outcomes for patients at risk of diabetic foot complications.

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