Research Article

Effectiveness of Foot Care Education in Improving Knowledge among Diabetic Patients

T. Suja[1], Santhi Appavu[2], D. Sasikala[3]

[1]Department of Medical Surgical Nursing, Apollo College of Nursing, The Tamil Nadu Dr. M.G.R. Medical University, Chennai, Tamil Nadu, India, [2]Department of Medical Surgical Nursing, Christian College of Nursing, Neyyoor, The Tamil Nadu Dr. M.G.R. Medical University, Chennai, Tamil Nadu, India, [3]Department of Fundamentals of Nursing, Apollo College of Nursing, The Tamil Nadu Dr. M.G.R. Medical University, Chennai, Tamil Nadu, India

Abstract

Introduction: Diabetic peripheral neuropathy is a common complication of diabetes, leading to loss of sensation in the feet and increasing the risk of foot ulcers and infections. Educating patients about proper foot care is crucial in preventing these complications.

Aim: This study aimed to evaluate the effectiveness of foot care education in improving knowledge regarding diabetic peripheral neuropathy among type 2 diabetic patients.

Objectives: The objectives include assessing the level of knowledge on peripheral neuropathy among diabetic patients in a selected community and determining the effectiveness of foot care education in improving diabetic patients' knowledge regarding foot care.

Methodology: A one-group pre-test–post-test research design was adopted. The study included 60 type 2 diabetic patients selected through convenience sampling from a selected Panchayat. Data were collected using pre-tested and validated tools, including a demographic variables proforma and a structured knowledge questionnaire administered through interviews. Then, foot care education was given; after 2 weeks, a post-test was conducted with the same tool.

Result: Before the intervention, 36.7% of participants had poor knowledge, 45% had moderate knowledge, 15% had good knowledge, and only 3.3% had excellent knowledge. The mean pre-test score was 7.2 ± 3.4, which increased to 13.3 ± 2.8 post-intervention, yielding a mean difference of 6.1. A paired t-test revealed a statistically significant improvement in knowledge ($P < 0.001$).

Conclusion: The study underscores the importance of incorporating foot care education into routine diabetes management programs. By enhancing patients' knowledge about diabetic peripheral neuropathy, such educational interventions can play a pivotal role in preventing foot-related complications and improving the overall quality of life for individuals with type 2 diabetes.

Keywords: Diabetes patients, education, foot care, knowledge, peripheral neuropathy

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Introduction

Diabetes mellitus is an increasingly common public health concern (Alshammari *et al.*, 2023) that affects people of all ages.[1] It is a chronic disease that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces. Diabetes is a major cause of morbidity and mortality, primarily due to its long-term complications. There are several forms of diabetes.

Address for correspondence:
T. Suja, Department of Medical Surgical Nursing, Apollo College of Nursing, The Tamil Nadu Dr. M.G.R. Medical University, Chennai, Tamil Nadu, India.
E-mail: sujaemil@gmail.com

Type 2 is the most common. If left untreated, the disease can lead to various health complications, including disorders of the cardiovascular system, eyes, kidneys, and nerves. A combination of treatment strategies can help to manage the condition to live a healthy life and prevent complications. There are other non-vascular complications of diabetes, including cataract formation and neuropathy. Peripheral neuropathy is a general term referring to nerve damage that causes weakness, pain, and numbness, usually in the hands and feet (Boulton, 1998).[2] Burning and shooting pain are common symptoms of neuropathic pain. The pain could be continuous or intermittent. According to the Cleveland Clinic, 30% of neuropathic pain is caused by diabetes (Moawad, 2024). Its prevalence increases with the duration of diabetes (Iqbal, 2018).[3,4] Diabetes is the leading cause of neuropathy globally, resulting in a variety of disorders affecting various nerve types and pathologic processes (Albers, Pop, 2014).[5] Maintenance of blood glucose level is the most important part of managing peripheral neuropathy. Since pain is related to blood glucose flux, constant blood glucose level is the key feature (Oyibo *et al.*, 2002).[6]

The prevalence of diabetic peripheral neuropathy was higher among diabetes mellitus patients, and it has a negative impact on the progression of diabetes mellitus (Suja *et al.*, 2025).[7] Viswanathan *et al.* (2005)[8] conducted a study to assess the prevalence of foot complications among 1319 type 2 diabetic patients from four different centers across India. The findings revealed that the prevalence of neuropathy was 15% ($n = 193$), PVD was 5% ($n = 64$), and infections were present in 7.6% ($n = 100$) of diabetic patients. Nearly 3% of diabetic patients had undergone a minor or major amputation**.**

Approximately 6% of diabetics experience foot issues, such as ulceration, infection, or tissue damage to the foot, which is known as "diabetic foot" (Mishra *et al.*, 2017).[9] A debilitating condition brought on by diabetes mellitus is diabetic foot (Alshammari *et al.*, 2023).[1] Walking barefoot is a general practice among rural populations in developing countries. This presents an additional risk for the development of diabetic foot complications (Jayasinghe *et al.*, 2007).[10] It may require amputation due to tissue deterioration, infection, and foot ulcers (Alshammari *et al.*, 2023).[1]

A majority of hospital admissions are due to diabetic foot ulcers, and it is also a major reason for amputations. More significantly, it can be prevented with proper detection, education, and preventive foot care. Numerous studies have shown the significance of diabetic foot care education and adherence to foot care practices (Jinadasa and Jeewantha, 2011).[11] Therefore, early diagnosis and timely treatment are essential to prevent the development and progression of diabetic neuropathy. It is still difficult to diagnose diabetic peripheral neuropathy and determine its incidence rates and worldwide prevalence (Carmichael *et al.*, 2021).[12]

According to the American Diabetes Association (ADA) and the Canadian Diabetes Association, diabetic neuropathy screening should be done at diagnosis and every year for patients with type 2 diabetes, 5 years after diagnosis, and thereafter every year for individuals with type 1 diabetes **(**Pop-Busui *et al.*, 2017).[13] Early detection of neuropathy enables medical professionals to take preventative actions, such as teaching patients about correct foot care, recommending suitable footwear, and doing routine foot examinations. The American Orthopedic Foot and Ankle Society's Diabetic Committee has developed guidelines for the application of preventive foot care. Self-examination and foot care techniques are taught in foot-specific patient education**.** For patients with peripheral neuropathy, individualized foot-specific education is recommended (Pinzur *et al.*, 2005).[14]

Calle-Pascual *et al.*, 2002 study found that following a preventive foot care program lowers the risk of foot ulcers in individuals with diabetic neuropathy. This program included proper footwear, walking foot hygiene, callus care, nail cutting, water temperature checks, the use of warming devices, bathroom surgery, foot care products, and self-inspection.[15] The ADA recommends that diabetic patients should have a visual examination of their feet at every visit, usually every 3–4 months, as well as a comprehensive foot examination once a year (Bodman *et al.*, 2024).[16] Poor foot care knowledge and practices are important risk factors among diabetic patients to develop foot complications (George *et al.*, 2013).[17] Proper foot care practices play an important role in preventing and treating these complications**.** Given the high prevalence of diabetic neuropathy and its complications, this study aimed to evaluate the impact of foot care education on improving knowledge among type 2 diabetic patients.

Problem statement

A study to evaluate the effectiveness of foot care education in improving knowledge among diabetic patients residing in a selected village in Kanniyakumari district.

Objectives

1. To assess the level of knowledge on peripheral neuropathy among diabetic patients in a selected community.
2. To determine the effectiveness of foot care education in improving diabetic patients' knowledge regarding foot care.

Null hypotheses

- H_{01}: There is no significant effect of foot care education on improving knowledge among diabetic patients.
- H_{02}: There is no significant association between knowledge level and selected demographic variables among diabetic patients.

Materials and Methods

Study design

This study adopted a quasi-experimental design (one group pre-test–post-test research design). The setting was chosen based on feasibility in terms of the availability of adequate

samples. The population of the study consisted of diabetic patients who were residing in Arumanai Panchayat of Kanniyakumari district, Tamil Nadu.

Sample size and selection criteria

The eligibility criteria were patients aged 41–70 years who knew Tamil and were willing to participate in the study from the selected village. The exclusion criteria were patients who were bedridden, unable to engage in educational sessions, and who could not understand Tamil. The sample size is based on a study by George *et al.*, 2013, considering a 75% proportion, $\alpha = 0.99$, design effect 2.0, and the obtained size was 40. Further, considering the 10% attrition rate and better generalization, a total of 60 diabetic patients who met the inclusion criteria were selected using the convenience sampling technique.

Tools

The data were collected through structured interviews using a knowledge questionnaire. Moreover, demographic variables of the proforma of diabetic patients, which included age, gender, marital status, education level, occupation, duration of diabetes, and source of health information, were collected. The structured knowledge questionnaire, developed by the researcher, consisted of 20 multiple-choice questions with four responses in each (one correct answer and four distractors). The score "1" was awarded for each correct answer. The total score ranges from excellent knowledge (16–20), good knowledge (11–15), moderate knowledge (6–10) to poor knowledge (0–5). The content validity was established based on the field experts' opinions, and the reliability was checked through Cronbach's alpha ($r = 0.81$).

Data collection method

The data collection was done for a period of 1 month during January 2024. The pre-test data on background characteristics and knowledge of foot care was collected using the pre-tested and pre-determined tools. After 2 weeks of foot care education, a post-test was conducted using the same questionnaire.

Intervention

The education program on foot care was conducted for the selected diabetic patients for 1 h in two batches using posters, PowerPoint presentations, and live foot care demonstrations.

Statistical method

The collected data were analyzed using descriptive statistics such as frequency, percentage, mean, and standard deviation and inferential statistics such as the Chi-square test and paired *t*-test.

Ethical approval

Institutional Ethical Committee clearance and setting permission from the concerned authorities were obtained to conduct the study. The purpose of the study was explained and written, oral consent was obtained from the patients who agreed to participate in the study.

Results

The percentage distribution of the demographic variables of the diabetic patients [Table 1] revealed that 38.3% of diabetic patients were aged between 41 and 50 years, 68.3% were females, 96.6% were married, 38.3% had primary school education, 36.7% were homemakers, 53.3% were Christian, 28.3% were having diabetes for about 6–10 years and 38.3% patients got previous knowledge from the Internet regarding foot care. The study results show that, out of 60 patients, 45% had a moderate level of knowledge, followed by poor knowledge (36.7%), good knowledge (5%), and excellent knowledge (3.3%), as in Table 2 and Figure 1. The results in

Table 1: Frequency and percentage distribution of demographic variables of the patients with diabetes mellitus (*n*=60)

Demographic variables	Frequency (f)	Percentage
Age		
41–50 years	23	38.3
51–60 years	16	26.7
61–70 years	21	35
Gender		
Male	19	31.7
Female	41	68.3
Marital status		
Married	58	96.6
Unmarried	1	1.7
Separated	1	1.7
Education level		
Primary	23	38.3
High school	15	25
Higher secondary	9	15
Degree	5	8.3
Postgraduate	8	13.3
Occupation		
Manual laborer	14	23.3
Homemaker	22	36.7
Private	21	35
Government	3	5
Religion		
Hindu	28	46.7
Christian	32	53.3
Muslim	0	0
Duration of diabetes		
<5 years	13	21.7
6–10 years	17	28.3
11–15 years	8	13.3
16–20 years	15	25
>20 years	7	11.7
Source of information		
Internet	23	38.3
Newspaper	14	23.3
Television	16	26.7
Radio	7	11.6

Table 2: Frequency and percentage distribution of level of knowledge among patients with diabetes mellitus (*n*=60)

Level of knowledge	Frequency (f)	Percentage
Excellent	2	3.3
Good	9	15
Moderate	27	45
Poor	22	36.7

Table 3 reveal a statistically significant improvement in all knowledge domains, such as peripheral circulation (MD = 1.2), foot assessment (MD = 1.0), foot hygiene (MD = 1.05), nail care (MD = 1.02), footwear (MD = 1.02), preventive measures (MD = 0.85) and overall knowledge (MD = 6.1), following the foot care education program ($P < 0.001$). This supports the alternative hypothesis H_1. These results suggest that foot care education is effective in improving the knowledge of diabetic patients on the prevention of peripheral neuropathy with an effect size of 1.90. The analysis in Table 4 revealed that there was no statistically significant association between the level of knowledge and the demographic variables such as age ($P = 0.18$), gender ($P = 0.73$), marital status ($P = 0.76$), education ($P = 0.16$), religion ($P = 0.91$), source of information ($P = 0.91$). There was a significant association of their knowledge level with occupation ($P = 0.0006$) and duration of diabetes mellitus ($P = 0.0007$). Hence, alternative hypothesis H_2, "There is a significant association between level of knowledge and selected demographic variables of diabetic patients," was partially accepted, as significant associations were found only for occupation and duration of diabetes ($P < 0.001$).

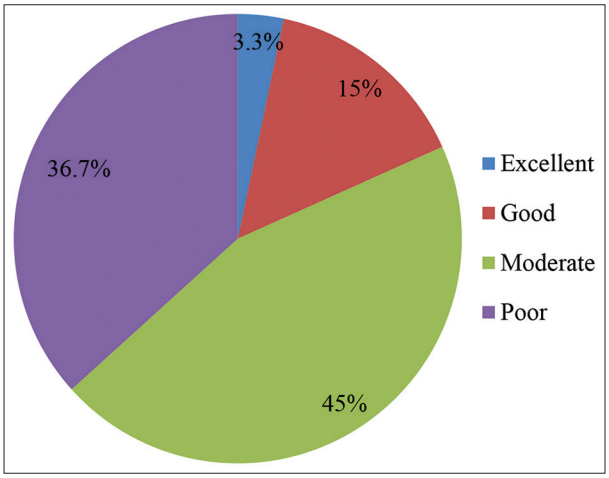

Figure 1: Level of knowledge on foot care among diabetic patients

Table 3: Comparison of pre-test and post-test knowledge on foot care among diabetic patients (*n*=60)

Components of knowledge	Pre-test knowledge		Post-test knowledge		MD	*t*-value	*P*-value
	Mean	SD	Mean	SD			
Peripheral circulation	0.8	0.6	1.9	0.7	1.12	19	<0.001
Foot assessment	1.2	0.7	2.2	0.6	1	15.9	<0.001
Foot hygiene	1.4	0.6	2.5	0.6	1.05	13.7	<0.001
Nail care	1.5	0.7	2.5	0.6	1.02	13.2	<0.001
Footwear	1.4	0.7	2.4	0.6	1.02	12.6	<0.001
Preventive measures	1	0.7	1.9	0.6	0.85	12	<0.001
Overall knowledge	7.2	3.4	13.3	2.8	6.1	36.5	<0.001

Table 4: Association between level of knowledge and selected demographic variables of diabetes patients (*n*=60)

Demographic variables	Level of knowledge		Chi-square value	*P*-value
	Frequency			
	Below mean	Above mean		
Age			1.76	0.18
41–60 years	21	18		
61–70 years	15	6		
Gender			0.12	0.73
Male	12	7		
Female	24	17		
Marital status			0.09	0.76
Married	35	23		
Unmarried/Separated	1	1		
Education			1.98	0.16
School level	26	21		
Graduate	10	3		
Occupation			11.85	<0.001
Manual Laborer/Homemaker	28	8		
Private/Government	8	16		
Religion			0.01	0.91
Hindu	17	11		
Christian/Muslim	19	13		
Duration of diabetes mellitus			11.5	<0.001
Up to 15 years	29	9		
Above 15 years	7	15		
Source of information			0.01	0.91
Internet, Newspaper	22	15		
Television, Radio	14	9		

Discussion

The primary objective of the study was to assess the effectiveness of foot care education in enhancing the knowledge of diabetic patients. The study revealed [Figure 1] that a majority of diabetic patients had only moderate (45%) or poor (36.7%) knowledge of foot care, with very few demonstrating good (15%) or excellent (3.3%) knowledge. This significant lack of awareness may increase the risk of complications such as peripheral neuropathy and foot ulcers. These findings underscore the need for structured foot care education as part of routine diabetes management. Health-care providers should prioritize individualized and group-based educational interventions to improve patient knowledge and promote preventive foot care behaviors.

The results are congruent with the study conducted by Pourkazemi *et al.* (2020) to determine the knowledge and practice regarding the prevention and care of foot ulcers among diabetics in Guilan Province, North Iran. A total of 375 diabetic patients were selected and the data were collected by interview method. The findings revealed that 84.8% of patients had poor knowledge, and only 15.2% had good knowledge. In terms of practice, 91.2% had poor practice, and only 8.8% had good practice. Adequate knowledge and good practices are important to effectively prevent foot complications. Patients require continuous support from family members to modify their lifestyle and behaviors and make sustainable changes to control their glycemic level and to follow effective foot care. Thus, health education about foot ulcer prevention should be provided to diabetic patients in the community and hospitals.[18]

The study results indicate that the knowledge levels appear to be relatively independent of age group, gender, educational background, marital status, religious affiliation, and source of health information. The absence of a significant association between knowledge level and variables such as age, gender, and education may be attributed to the widespread availability of diabetes-related information across all demographic groups. With increased access to health education through clinics, media, and digital platforms, individuals of different ages, genders, and educational backgrounds may acquire similar levels of knowledge. In addition, standardized diabetes education provided in health-care settings may help bridge knowledge gaps irrespective of these demographic factors. In contrast, two variables demonstrated a statistically significant association with knowledge levels, i.e., occupation and duration of diabetes mellitus patients engaged in private or government jobs had higher knowledge scores compared to those working as coolies or homemakers. This may be attributed to greater health awareness, better access to information, or higher health literacy in the employed population. Patients with a history of diabetes exceeding 15 years had significantly better knowledge. This finding suggests that prolonged exposure to diabetes care and repeated contact with health professionals may enhance patients' understanding and awareness of potential complications, including peripheral neuropathy. These results underscore the importance of targeted health education initiatives, particularly for individuals with shorter durations of diabetes and those from lower occupational backgrounds. Strengthening awareness programs and providing accessible, tailored education may empower all patients to actively engage in the prevention of diabetic complications.

The results are in collaboration with the study by Viswanathan *et al.*, 2005, to determine the positive impact of foot care education in preventing foot amputations in South India. A total of 4,872 patients were categorized under three groups. Group 1 – Diabetic patients with neuropathy (n = 2,871), Group 2 – Diabetic patients with neuropathy and deformity (n = 235), and Group 3 – Diabetic patients with neuropathy, deformity, and foot ulceration or peripheral vascular disease (n = 1766). All subjects were educated regarding diabetic foot disease and its complications and prevention. The result revealed that among the total patients, only three patients came for follow-up, others strictly followed the advice given, and 269 patients did not follow the advice. Most of the patients developed new problems (26%) and required surgical intervention (14%) when compared with those who followed advice (5 and 3%), respectively. Hence, intensive management and foot care education are effective in preventing newer problems and surgery.[19]

The study findings are congruent with another study conducted by Saurabh *et al.*, 2014, to determine the effectiveness of health education in improving foot care practice among diabetic patients. The findings revealed that after 2 weeks of health education, the average score for the practice of foot care was improved from 5.9 ± 1.82 to 8.0 ± 1.3. These results suggest that foot care education is a highly effective preventive measure for reducing complications associated with diabetic peripheral neuropathy.[20] It empowers patients to take responsibility for their health, ultimately leading to better outcomes. However, to maximize effectiveness, education must be accessible, tailored, and continuously reinforced. In summary, while foot care education has shown positive results in improving patient outcomes, its success is closely tied to how it is delivered and the patient's ability to adhere to the recommended practices. To ensure such benefits are realized on a larger scale, foot care education should be routinely provided by nurses, diabetes educators, and podiatrists during outpatient visits and diabetes clinics. Education can be delivered through individual counseling, group sessions, practical demonstrations, and visual aids. In community settings, community health nurses and ASHA workers can conduct local health camps, home visits, and awareness programs using tools such as flipcharts, audio-visual materials, and mobile apps tailored to the literacy level of the population. Regular reinforcement and follow-up will help sustain knowledge and support long-term behavior change, thereby improving patient outcomes. Incorporating foot care education into primary health care and chronic disease management protocols can significantly reduce the risk of foot complications among diabetic patients.

Conclusion

Foot problems are a leading cause of hospitalization and amputations among individuals with diabetes, particularly those with diabetic peripheral neuropathy (DPN). DPN impairs sensation in the feet, increasing the risk of unnoticed injuries and infections. Effective foot care education has been shown to improve patients' knowledge, attitudes, and practices, thereby reducing the incidence of foot ulcers and amputations. This education empowers patients to incorporate daily foot care routines, such as regular inspections, proper hygiene, and appropriate footwear, into their lives. Integrating foot care education into the management of DPN is essential for preventing complications and enhancing patient outcomes using visual aids and practical demonstrations to enhance understanding, especially among low-literacy populations, conducting regular follow-up and reinforcement sessions to ensure retention and application of knowledge and encouraging multidisciplinary involvement, including nurses, podiatrists, and diabetes educators, in patient education initiatives.

Future scope

To further enhance the effectiveness of foot care education, future studies could explore long-term knowledge retention and its impact on sustained behavior change. In addition, conducting large-scale population studies would provide valuable insights into the broader applicability and scalability of educational interventions across diverse demographic groups.

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Conflicts of Interest

The authors declare no conflicts of interest.

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