ORIGINAL ARTICLE

Effectiveness of Educational Intervention to Improve Knowledge and Practices regarding Foot Care among Patients with Type 2 Diabetes

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Abstract

Background: Foot complications are a major cause of morbidity in type 2 diabetes. Simple educational interventions can improve foot care knowledge and practices, potentially reducing diabetic foot ulcers and lower-limb amputations, especially in resource-limited settings.

Objective: To evaluate the effectiveness of an educational intervention in improving foot care knowledge and practices among patients with type 2 diabetes attending outpatient clinics of a tertiary care hospital in Karachi, Pakistan.

Methods: This quasi-experimental pre-post study was conducted at diabetes clinics of Liaquat National Hospital's community outreach centers from May 2024 to April 2025 and included 200 adults with type 2 diabetes. The intervention comprised a 5-minute face-to-face foot care education session based on American Diabetes Association 2024 guidelines, written material, and monthly WhatsApp reminders. Knowledge and practices were assessed at baseline, and then reassessed after the educational intervention. Foot care knowledge and practices were assessed using a semi-structured questionnaire and the Nottingham Assessment of Functional Foot Care tool. Data was analyzed using Stata version 14.

Results: Among 200 patients (mean age 52.6 ± 12.8 years; 63% female), mean knowledge scores improved significantly from 8.3 ± 2.7 to 11.2 ± 2.5 ($p<0.001$), with adequate knowledge increasing from 26.5% to 76%. Mean practice scores also rose from 43.3 ± 9.4 to 62.4 ± 11.7 ($p< 0.001$), while adequate practices increased from 21.5% to 78%.

Conclusion: A simple educational intervention was associated with significant short-term improvements in foot care knowledge and practices among patients with type 2 diabetes. However, the lack of a control group in our study limited causal conclusions and comparisons of other strategies.

Keywords: *Type 2 diabetes, diabetic foot care, diabetic foot care knowledge, diabetic foot care practices, diabetes management, effectiveness of intervention.*

INTRODUCTION

Diabetes threatens the lives of more than 285 million people around the world, and the worldwide number of people with diabetes will grow to 439 million by 2030. It has been estimated that by the year 2030, a 69% increase in the prevalence of diabetes in low and middle-income countries is likely [1]. Pakistan is third in the world for diabetes incidence, after China and India [2]. Diabetes prevalence in 2022 was projected to be approximately 26.7% of adults in Pakistan for an estimated number of ~33 million cases reported by the International Diabetes Federation [2]. Diabetes is known to have several serious complications, including diabetic foot complications that result in further morbidity and mortality and significantly reduced quality of life.

Diabetes induced foot problems are frequent chronic sequelae and can result in huge economic costs with significant social impacts [3]. Lifetime risk of developing a foot ulcer in individuals with diabetes is 15%, and it is estimated that between 14-25% of diabetic foot ulcers are followed by an amputation [4]. In ADA 2024, patient education is crucial for preventing diabetic foot complications, with regular education on everyday foot inspection and care, nail care, footwear, hygiene, and reporting any injuries or infections [5]. Research has shown that the better patients are informed about foot care, the more likely they are to follow good foot care practices and lower their risk of complications [6, 7]. It is also recommended to have annual comprehensive foot exams, individualized education, and reinforcement at clinic visits. Overcrowded clinics and the sheer number of patients in developing countries frequently make it difficult to teach good foot care.

A cross-sectional study in Northwest (NW) Ethiopia found that 46.4% of respondents had poor foot care. The factors found to be associated with these results were male sex, being illiterate, rural living, presence of diabetes complications, combined injection and oral medication use regimen, no history of foot care knowledge, and low-income family support [8]. Concurrently, high-risk patients accounted for 31.5% in a study conducted in Egypt, and educational interventions led to significant improvement in both knowledge scores (8.17±2.4 *vs* 16.16±2.3) and practice [3]. These findings highlight the necessity of patient education and information campaigns, especially at the primary care level. However, in Pakistan, foot care adoption is influenced by several factors, including differences in socioeconomic status, health literacy,

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health-seeking behavior, overcrowded clinics, and cultural practices such as barefoot walking. Therefore, the effectiveness of similar interventions needs to be examined locally.

Around 60% of diabetic patients lacked appropriate foot care knowledge and practices at the population-based level survey among individuals with diabetes that was conducted in Pakistan, where only 16% showed good levels. At the same time, poor performance was associated with low education and insufficient counseling [9]. Likewise, a recent randomized controlled trial from Karachi by Sharif *et al.* evaluated a pictorial education tool in patients with type 2 DM and found improved knowledge [10]. However, the study was limited to knowledge outcomes alone, without considering foot care practices, which are essential for preventing diabetic foot ulcers. Knowledge itself, however, may not necessarily result in appropriate self-care, and it is important to measure practices as well as knowledge if we are to fully establish the effectiveness of interventions.

Although the importance of patient knowledge is well established, evidence regarding the effectiveness of educational interventions in improving diabetic foot care practices remains limited and variable across different settings [11]. Additionally, there is a paucity of studies from Pakistan evaluating the impact of health education on diabetic foot care practices, particularly within primary care settings. Therefore, this study aimed to evaluate the effectiveness of an educational intervention in improving foot care knowledge and practices among patients with type 2 diabetes attending outpatient clinics of a tertiary care hospital in Karachi, Pakistan.

METHODS

This pre- and post-quasi-experimental study was conducted from May 2024 to April 2025 in diabetes clinics of Liaquat National Hospital's Community Outreach Centers in Karachi, following ethical approval (ERC # 1004-2024-LNH-ERC). Using the non-probability convenience sampling technique, 220 adult patients (≥18 years) with type 2 diabetes of at least three months' duration who understood Urdu and verbally consented were recruited. At the same time, those with foot ulcers, foot deformities, peripheral vascular disease, cognitive/psychiatric disorders, sensory impairments, or no Android phone were excluded.

A previously conducted study showed that, at baseline, the overall knowledge score was 0.25 ± 0.14, and 0.75 ± 0.27 after the intervention [12]. Based on findings from a previous study [12], a sample size of 30 was calculated using 90% power and a 95% confidence interval. However, to detect a smaller effect size of 0.2 with 80% power and a 95% confidence interval, a sample of 199 patients was required. To account for potential loss to follow-up, 220 participants were recruited. Of these, 200 participants completed the post-test survey, while the remaining participants were lost to follow-up.

The educational intervention included three components: a structured 5-minute face-to-face foot care session conducted according to ADA 2024 guidelines[5]; provision of written educational materials in Urdu covering the same key points; and monthly WhatsApp reminders over three months to reinforce the education and support sustained behavioral change. The educational material was designed in accordance with the ADA 2024 guidelines. The educational session followed a structured checklist covering foot hygiene, nail care, footwear selection, daily inspection, and when to seek medical care. A standardized script was used to ensure consistency across all sessions. We adopted this three-component intervention to enhance behavioral reinforcement through multiple delivery models. Face-to-face education improves comprehension and provides clarification; written material can serve as a home reference and support retention, whereas monthly reminders support continuity and behavioral reinforcement.

The study questionnaire consisted of three sections. The first section included demographic variables such as age, gender, ethnicity, employment, and level of education. The second part evaluated knowledge related to diabetic foot care, and the third part evaluated practice-related questions.

The knowledge part consisted of 14 items in total. We have further subdivided the knowledge items into subcomponents, including diabetes and its complications (5 items), foot care (7 items), and footwear and thermal care (2 items). The responses to all 14 items were binary (yes/no). A score of 1 is assigned to the correct response. Thus, overall knowledge scores vary from 0 to 14. Adequate knowledge was considered with a score of at least 80% of correct answers, yielding a threshold of 11 or above. The questionnaire for knowledge assessment was self-designed by the study authors, based on a review of the literature and recommendations issued by the ADA [5]. The other two experts reviewed the content validity: one endocrinologist and another Family Medicine specialist. A pilot study was conducted further to confirm the tool's face validity and feasibility. The pilot study included 30 patients. The responses during the pilot study helped identify unclear terms and rephrase questions in a more appropriate way. Moreover, the Cronbach's alpha value for the final study tool was 0.78, confirming the tool's reliability. The questionnaire for the knowledge part is provided in a supplementary file.

The third part assessed foot care practices using the validated Nottingham Assessment of Functional Foot Care (NAFF) tool. The NAFF tool comprises 26 items. The response is rated on a 4-point Likert scale from 0 to 3. There are adequate practices for those with a score of 50 or higher, while poor practices for those with a score of 50 or lower [13].

Eligible patients attending diabetes clinics were recruited after physician consultations, provided informed

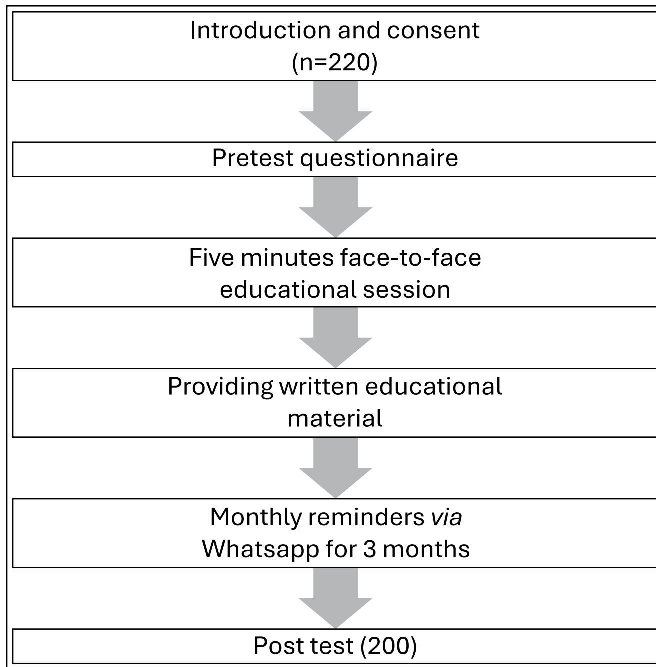

Fig. (1): Flow chart for interventional study.

consent, and completed a baseline assessment of foot care knowledge and practices. Trainee physicians (year 2 and year 3 trainees), who received prior training on the study protocol and educational content, delivered a standardized 5-minute face-to-face educational session, supplemented with Urdu-language written materials and monthly WhatsApp reminders over three months. Knowledge and practices were reassessed three months later using the same questionnaire (**Fig. 1**). Periodic supervision and random session checks were conducted to ensure adherence to the intervention protocol.

The collected data were first entered into Microsoft Excel and then imported into Stata version 14 for statistical analysis. Frequencies and percentages were computed for categorical tests. Numerical variables were first assessed for normality using the Shapiro-Wilk test and were found to be normally distributed; thus, they were expressed as mean ± standard deviation. Numerical data before and after intervention were compared using a paired t-test. Two-by-two categorical data were compared using McNemar's test. Distribution of categorical data with more than two categories was tested using the Stuart-Maxwell test. A p-value less than or equal to 0.05 was deemed statistically significant for overall knowledge and practice scores. P-values for sub-scales of knowledge and practice level were considered based on the Bonferroni correction. For the knowledge sub-scale, the level of significance was 0.004 (0.05/14), whereas for the practice sub-scales, it was 0.002 (0.05/26).

RESULTS

Summary of Socio-Demographic Features

Of 220 enrolled participants, 200 (90.9%) completed the 3-month follow-up; 20 (9.1%) lost to follow-up. A final analysis was run on 200 patients who completed follow-up. The average age of patients was 52.6 ± 12.8 years. Nearly two-thirds were females (63.0%). The majority had completed high school or higher (51.5%). Most of the patients were homemakers (43.0%). The average duration of diabetes was 8.1 ± 2.9 years (**Table 1**).

Table 1: Summary of patients' features.

Variable	Categories	Frequency	Percentage
Age	18-19 years	4	2.0
	21-29 years	12	6.0
	30-39 years	12	6.0
	40-49 years	34	17.0
	50-59 years	73	36.5
	60 years and above	65	32.5
Gender	male	74	37.0
	female	126	63.0
Ethnicity	Urdu speaking	94	47.0
	Sindhi	34	17.0
	Punjabi	40	20.0
	Pashtun	12	6.0
	Balochi	14	7.0
	Others	6	3.0
Education	no formal education	20	10.0
	madrasa only	5	2.5
	primary	12	6.0
	secondary	6	3.0
	matric	29	14.5
	intermediate	25	12.5
	graduate	43	21.5
	postgraduate	60	30.0
Employment	self-employed	18	9.0
	unemployed	32	16.0
	home maker	86	43.0
	job	64	32.0
Disease duration	≤2 years	44	22.0
	3-5 years	47	23.5
	>5 years	109	54.5
Have you had your HbA1c done in the past 3 months?	yes	125	62.5
	no	75	37.5
Consulted the physician in the past 3 months?	yes	108	54.0
	no	92	46.0

Knowledge Status at Baseline and after Intervention

Fig. **(2)** displays a comparison of knowledge items regarding diabetes and its complications before and after intervention. After intervention, knowledge increased for all items except the role of blood sugar in preventing foot problems (p=0.059).

No significant change in knowledge was observed after the intervention regarding the use of heaters in winter to keep feet warm (p=0.160) and the role of blood sugar in preventing foot problems (p=0.059). Besides these two items, an increase in knowledge was observed after the intervention for the remaining knowledge items.

Fig. **(3)** shows a comparison of knowledge items regarding foot care before and after intervention.

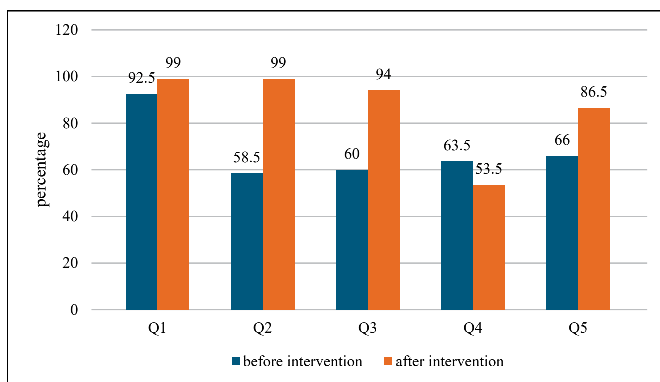

Fig. (2): Knowledge regarding diabetes and its complications before and after intervention.

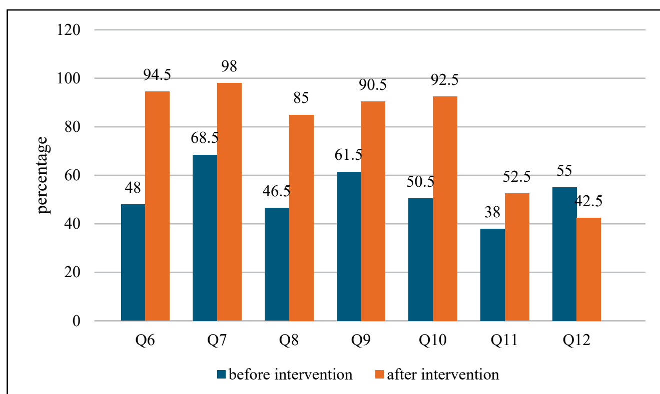

Fig. (3): Knowledge regarding foot care before and after intervention.

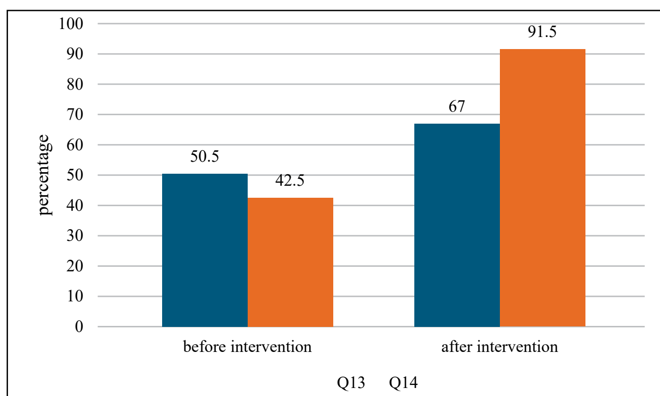

Fig. (4): Knowledge regarding footwear and thermal care before and after intervention.

Knowledge increased for all items with the knowledge component of foot care, except for knowledge regarding removal of corn and calluses (p=0.018) and trimming of toenails (p=0.009), as the p-values were higher than the Bonferroni corrected p-value of 0.004.

Fig. **(4)** depicts comparison of knowledge items regarding footwear and thermal care before and after intervention. Of the two items in this knowledge component, knowledge about removing calluses increased significantly. In contrast, knowledge about using heaters in winter to keep feet warm did not improve after the intervention (p=0.160).

Knowledge scores before and after the intervention were 8.3 ± 2.7 and 11.2 ± 2.5, respectively (p < 0.001).

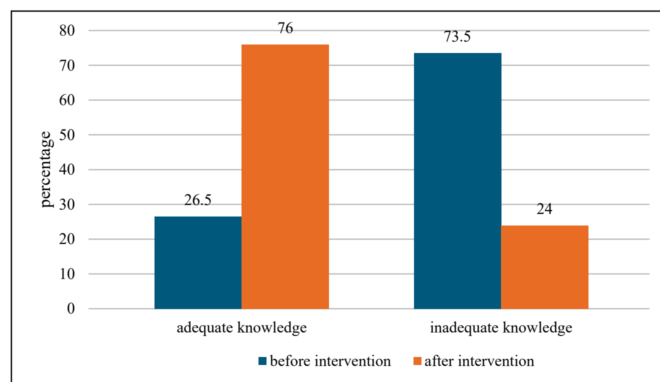

Fig. (5): Frequency of adequate and inadequate knowledge before and after intervention.

Table 2: Comparison of overall knowledge score before and after intervention on stratification of disease duration and consultation with a physician in the past 3 months.

Variables	Before intervention mean±SD	After intervention mean±SD	p-value	Cohen's d effect size point estimate (95% CI)
Disease duration				
≤2 years	7.8±2.7	10.8±1.5	<0.001	1.1 (0.7-1.5)
3-5 years	7.5±2.6	11.1±1.6	<0.001	1.7 (0.9-1.8)
>5 years	8.8±2.7	11.4±1.5	<0.001	1.3 (0.9-1.3)
Consulted the physician in the past 3 months?				
Yes	8.1±2.3	11.2±1.3	<0.001	1.2 (0.9 - 1.4)
No	8.4±2.8	11.3±1.7	<0.001	1.2 (0.9-1.4)

The average increase in post-knowledge score from baseline was 2.9 ± 2.5. Cohen's d effect size was 1.2 (95% CI: 0.9 - 1.3). Fig. **(5)** displays frequency of adequate and inadequate knowledge before and after intervention. Before intervention, the proportion with adequate knowledge was 26.5%, which increased to 76% after intervention (p<0.001).

Table **2** presents a comparison of the knowledge score before and after the intervention, stratified by disease duration and consultation with a physician in the past 3 months. Knowledge score increased after intervention across all disease duration and health frequency contact strata.

Practice Level at Baseline and after Intervention

Table **3** outlines a comparison of practice items before and after the intervention. Improvement in practice items was observed for all items except wearing pointed-toe shoes (p=0.019), wearing flip-flops or mules (p=0.362), and walking outside in bare feet (p=0.257).

Table 3: Comparison of practice items before and after intervention.

Practice items	Item category	Practice level before intervention n(%)	Practice level before intervention n(%)	p-value
Do you examine your feet?	once a week or less	39(19.5)	5(2.5)	<0.001
	2-6 times a week	3(1.5)	3(1.5)	
	once a day	73(36.5)	53(26.5)	
	more than once a day	85(42.5)	139(69.5)	

Practice items	Item category	Practice level before intervention n(%)	Practice level before intervention n(%)	p-value
Do you check your shoes before you put them on?	never	64(32)	0(0)	<0.001
	rarely	31(15.5)	6(3)	
	sometimes	33(16.5)	40(20)	
	often	72(36)	154(77)	
Do you check your shoes when you take them off?	never	111(55.5)	22(11)	<0.001
	rarely	29(14.5)	23(11.5)	
	sometimes	16(8)	40(20)	
	often	44(22)	115(57.5)	
Do you wash your feet?	never	3(1.5)	0(0)	<0.001
	rarely	0(0)	1(0.5)	
	sometimes	25(12.5)	24(12)	
	often	172(86)	175(87.5)	
Do you check your feet are dry after washing?	never	118(59)	9(4.5)	<0.001
	rarely	35(17.5)	24(12)	
	sometimes	15(7.5)	44(22)	
	often	32(16)	123(61.5)	
Do you dry between your toes?	never	147(73.5)	24(12)	<0.001
	rarely	25(12.5)	36(18)	
	sometimes	5(2.5)	25(12.5)	
	often	23(11.5)	115(57.5)	
Do you use moisturizing cream on your feet?	never	87(43.5)	7(3.5)	<0.001
	rarely	19(9.5)	20(10)	
	sometimes	23(11.5)	38(19)	
	often	71(35.5)	135(67.5)	
Do you put moisturizing cream between your toes?	never	124(62)	19(9.5)	<0.001
	rarely	13(6.5)	21(10.5)	
	sometimes	13(6.5)	39(19.5)	
	often	50(25)	121(60.5)	
Are your toenails cut?	never	4(2)	1(0.5)	0.203
	rarely	8(4)	5(2.5)	
	sometimes	61(30.5)	63(31.5)	
	often	127(63.5)	131(65.5)	
Do you wear slippers with no fastening?	never	132(66)	32(16)	<0.001
	rarely	49(24.5)	55(27.5)	
	sometimes	16(8)	32(16)	
	often	3(1.5)	81(40.5)	
Do you wear trainers?	never	19(9.5)	11(5.5)	0.003
	rarely	79(39.5)	56(28)	
	sometimes	27(13.5)	47(23.5)	
	often	75(37.5)	86(43)	
Do you wear shoes with lace-up, Velcro, or strap fastenings?	never	14(7)	4(2)	<0.001
	rarely	67(33.5)	33(16.5)	
	sometimes	31(15.5)	39(19.5)	
	often	88(44)	124(62)	
Do you wear pointed-toed shoes?	never	14(7)	12(6)	0.019
	rarely	40(20)	22(11)	
	sometimes	24(12)	31(15.5)	
	often	122(61)	135(67.5)	
Do you wear flip-flops or mules?	never	22(11)	19(9.5)	0.362
	rarely	41(20.5)	41(20.5)	
	sometimes	23(11.5)	35(17.5)	
	often	114(57)	105(52.5)	
Do you break in new shoes gradually?	never	99(49.5)	28(14)	<0.001
	rarely	72(36)	49(24.5)	
	sometimes	25(12.5)	55(27.5)	
	often	4(2)	68(34)	

Practice items	Item category	Practice level before intervention n(%)	Practice level before intervention n(%)	p-value
Do you wear artificial-fiber (*e.g.*, nylon) socks?	never	56(28)	20(10)	<0.001
	rarely	76(38)	38(19)	
	sometimes	23(11.5)	43(21.5)	
	often	45(22.5)	99(49.5)	
Do you wear shoes without socks/ stockings/ tights?	never	28(14)	12(6)	<0.001
	rarely	69(34.5)	23(11.5)	
	sometimes	24(12)	59(29.5)	
	often	79(39.5)	106(53)	
Do you change your socks/ stockings/ tights?	never	32(16)	11(5.5)	<0.001
	rarely	102(51)	34(17)	
	sometimes	55(27.5)	128(64)	
	often	8(4)	27(13.5)	
Do you walk around the house barefoot?	never	32(16)	4(2)	<0.001
	rarely	55(27.5)	19(9.5)	
	sometimes	26(13)	36(18)	
	often	87(43.5)	141(70.5)	
Do you walk outside barefoot?	never	4(2)	2(1)	0.257
	rarely	5(2.5)	2(1)	
	sometimes	13(6.5)	9(4.5)	
	often	178(89)	187(93.5)	
Do you use a hot water bottle in bed?	never	7(3.5)	5(2.5)	<0.001
	rarely	41(20.5)	12(6)	
	sometimes	35(17.5)	26(13)	
	often	117(58.5)	157(78.5)	
Do you put your feet near the fire?	never	8(4)	2(1)	<0.001
	rarely	54(27)	17(8.5)	
	sometimes	34(17)	29(14.5)	
	often	104(52)	152(76)	
Do you put your feet on a radiator?	never	9(4.5)	5(2.5)	<0.001
	rarely	45(22.5)	17(8.5)	
	sometimes	25(12.5)	26(13)	
	often	121(60.5)	152(76)	
Do you use corn remedies/ corn plasters/ paints when you get a corn?	never	41(20.5)	6(3)	<0.001
	rarely	63(31.5)	19(9.5)	
	sometimes	24(12)	33(16.5)	
	often	72(36)	142(71)	
Do you put a dry dressing on a blister when you get it one?	never	30(15)	7(3.5)	<0.001
	rarely	89(44.5)	23(11.5)	
	sometimes	29(14.5)	26(13)	
	often	52(26)	144(72)	
Do you put a dry dressing on a graze, cut, or burn when you get one?	never	34(17)	8(4)	<0.001
	rarely	87(43.5)	26(13)	
	sometimes	25(12.5)	22(11)	
	often	54(27)	144(72)	

Practice scores before and after the intervention were 43.3±9.4 and 62.4±11.7, respectively (p<0.001). Mean difference after intervention was 19.1±13.1. Cohen's d effect size was 1.5 (95% CI: 1.2-1.7). Fig. **(6)** displays frequency of adequate and inadequate practice before and after intervention. Before intervention, the frequency of adequate practice was 21.5%, compared to 78.0% after intervention (p<0.001).

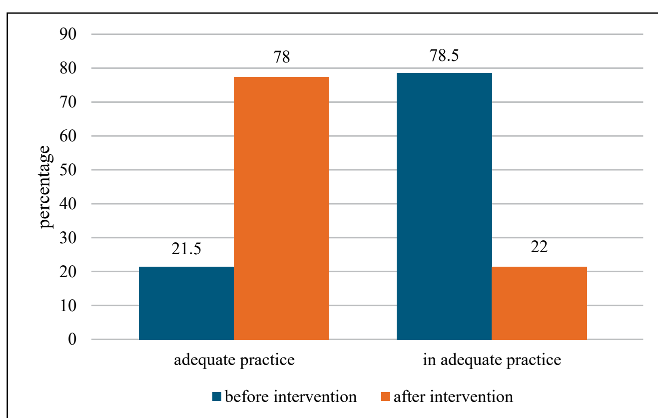

Fig. (6): Frequency of adequate and inadequate practice before and after intervention.

Table 4: Comparison of overall practice score before and after intervention on stratification of disease duration and consultation with a physician in the past 3 months.

Variables	Before intervention mean±SD	After intervention mean±SD	p-value	Cohen's d effect size point estimate (95% CI)
Diabetes duration				
≤2 years	40.6±10.7	66.8±7.5	<0.001	2.2 (1.6-2.7)
3-5 years	40.2±7.4	60.9±11.4	<0.001	1.5 (1.2-2.1)
>5 years	45.7±9.1	61.3±10.8	<0.001	1.3 (1.0-1.5)
Consulted the physician in the past 3 months?				
Yes	41.9±9.2	63.3±10.5	<0.001	1.6 (1.3-1.9)
No	44.8±9.5	61.3±13.1	<0.001	1.3 (1.1-1.6)

Stratified practice scores before and after intervention, based on disease duration and consultation with a physician in the past 3 months, are presented in Table **4**. Practice score increased after intervention across all disease duration and health frequency contact strata.

DISCUSSION

Educational interventions have been widely reported as an effective strategy for improving foot care knowledge and practices among patients with diabetes, with systematic reviews demonstrating significant improvements in both knowledge and preventive behaviors [6, 14, 15]. Additionally, individual trials have demonstrated improved foot care knowledge and practices following structured face-to-face educational interventions [11, 16, 17]. The intervention in our study was an adapted, face-to-face foot care education approach to improve patients' knowledge and practices of caring for their feet, a crucial and underexplored condition in diabetes self-management.

In this study, the majority of participants had formal education and, at baseline, had suboptimal knowledge and practices regarding diabetic foot care. More than half of participants (51.5%) had a higher level of education; however, the mean baseline knowledge score was 8.3±2.7 out of 14, and only 26.5% achieved the adequate knowledge cut-off point (≥80%). Participants' foot care practices were also found to be suboptimal at baseline, with a mean practice score of 43.3 ± 9.4 out of 78, and only 21.5% had adequate foot care practices. These results suggest that formal education is not always sufficient to achieve disease-related self-care practices. One possible reason for the gap is a focus on symptom-based diabetes care, which could lead to less attention to preventive foot care during regular clinical consultations and a lack of structured programs on foot care at the primary health level.

Our study showed that the proportions of good knowledge and poor knowledge were 26.5% and 73.5%, respectively, at a baseline exam. This is consistent with our local studies and the study by Mushtaq *et al.* [18], who found that only 20% of patients had good knowledge of diabetic foot care three months after an educational intervention, along with monthly WhatsApp reminders to reinforce behavior change. The number of participants with adequate knowledge increased from 26.5% to 76%. Moreover, participants who had inadequate knowledge at baseline showed a substantial increase in knowledge, suggesting that participating in the intervention was associated with improved knowledge levels. There were improvements across most knowledge domains, such as knowledge of the risk of foot ulcers and amputations, regularly inspecting the feet, using adequate footwear, avoiding walking barefoot, quitting smoking, trimming nails safely, and following appropriate skin care. These results are also similar to those of a study conducted in slum areas of Karachi, where knowledge improved from 35% pre-intervention to 89% post-intervention [10]. However, a 3-month follow-up cannot assess sustainability; Sharif *et al.* (2025) reported 40% knowledge decay at 6 months post-intervention in Karachi slums, suggesting booster sessions may be necessary to maintain behavior change [10]. In our study, there is no statistically significant increase seen in the knowledge of use of heaters during winter, trimming of toenails, removal of corn and calluses, or the role of glycemic control to prevent foot problems, probably due to pre-set beliefs that were difficult to change and comparatively less relevance of using heaters in a tropical city like Karachi. The lack of progress in knowledge about glycemic control underscores the importance of aligning footcare education with comprehensive diabetes self-management strategies.

Regarding practices, as reported by Tariq *et al.,* we observed that the rate of good practices was also 21.5% at baseline [19]. Our results showed that after the intervention, there was an increase in adequate foot care practices from 21.5% at baseline to 78%. In particular, more than three-fourths of the participants who had insufficient practice at baseline reached sufficient levels after the intervention, which represents a practical behavioral change. As in our study, an Indian rural [20] and an Iranian [11] study found positive impacts on diabetic foot care practices after the provision of targeted health education. The improvements were

observed in domains such as regular inspection of feet, using appropriate footwear, inspecting shoes before wearing them, following foot hygiene, including regular moisturization of feet, following proper nail trimming, and avoiding heat exposure to feet, either directly or indirectly. All these practices play a crucial role in preventing foot ulcers, which can lead to further complications. However, no changes were observed in domains such as the use of flip-flops and pointed-toe shoes, or barefoot walking outdoors. This might be due to culturally established behaviors or socioeconomic influences, underscoring the importance of offering regular reminders and community-based interventions to maintain behavioral changes.

These preliminary findings from a single-arm study may inform clinical practice considerations; however, further controlled studies are required before policy-level implications can be drawn. Given the absence of a control group, these findings should be interpreted as associative rather than causal, as external influences such as increased awareness, concurrent physician counseling, or the Hawthorne effect cannot be excluded. Incorporating structured foot care information into everyday outpatient diabetes care may improve patient self-care and further reduce the incidence of foot ulcers, infections, and amputations, as suggested in prior literature [21]. It may be feasible for primary care providers to provide these interventions as part of routine care [21]. This kind of straightforward educational intervention is especially useful in resource-constrained environments like Pakistan due to its affordability and practicality. Future implementation should include culturally appropriate messaging, visual aids, and reinforcement to refute beliefs and sustain them over time for behavior change.

LIMITATIONS

Our study has some limitations that should be considered. In our study, a single-arm design lacking a control group severely restricted our ability to make causal inferences about the impact of the educational intervention or to compare it with other educational strategies. Another major limitation of our study was that we had to rely on self-reported behaviors, which can lead to recall bias, as participants might not remember how they cared for their feet during a defined period. Academic education level was assessed rather than health literacy levels. We also identified the possibility of social desirability bias, in which participants may overreport positive behaviors to meet the expectations of healthcare workers. Both recall and social desirability biases could have led to an overestimation of the improvements in foot care observed in our study. It should also be noted that knowledge retention and behavior maintenance over longer periods could not be evaluated with a 3-month follow-up. Lastly, our study is a single-center design, which may reduce the generalization of the results to other health care settings, especially in rural or resource-limited areas.

Furthermore, a randomized controlled trial is required to determine the long-term utility of the educational intervention on clinically relevant outcomes, such as foot ulcer incidence and amputation rates. Future research should address the limitations of the current study, including a longer follow-up period, to understand knowledge retention and continued behavior change better.

CONCLUSION

A simple educational intervention was associated with significant short-term improvements in foot care knowledge and practices among patients with type 2 diabetes. However, the lack of a control group in our study limited causal conclusions and comparisons of other strategies. This study suggests that integrating a brief, structured education session, reinforced by low-cost methods like written materials and mobile phone reminders, into routine diabetes clinic visits could be a feasible strategy to empower patients and potentially reduce the burden of diabetic foot complications in primary care settings. More community- and multicenter -interventional studies are needed to assess the long-term sustainability of these results in relation to diabetic foot complications.

ETHICS APPROVAL

Ethical approval was obtained from Liaquat National Hospital (ERC # 1004-2024-LNH-ERC). All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and the Helsinki Declaration.

CONSENT FOR PUBLICATION

All participants provided informed consent before participating in the study.

AVAILABILITY OF DATA

The data of this study are available upon request.

FUNDING

None.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORS' CONTRIBUTION

Fatima Asghar proposed the study concept, developed the study protocol, and drafted the manuscript. Rabeeya Saeed contributed to the study design and critically reviewed the manuscript. Aqiba Sarfaraz designed the study protocol, reviewed and revised the manuscript draft. Noureen Durrani performed the statistical analysis and contributed to data interpretation, result writing

and also contributed to initial manuscript drafting. All authors reviewed and approved the final version of the manuscript.

SUPPLEMENTARY MATERIAL

Supplementary material is available on the journal's website.

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