Effect of Educational Program on Knowledge and Preventive Practices Regarding Foot Ulcers among Diabetic Patients in Bangladesh

Abstract

Background: Diabetic foot ulcer (DFU) is a significant health issue among diabetic patients. Educational programs are crucial for enhancing knowledge and preventive practices related to DFU. This study aimed to evaluate the effect of an educational program on knowledge and preventive practices regarding diabetic foot ulcers among diabetic patients in Bangladesh.

Methods: A quasi-experimental one-group pretest-posttest design was implemented, featuring a six-day educational program followed by a two-week follow-up. The study took place at Upazila Health Complex, Galachipa, from October to November 2023, involving 42 conveniently selected diabetic patients. Data were collected through face-to-face interviews. The program included information on knowledge and preventive practices, delivered through lectures, discussions, and demonstrations using various audio-visual aids. Data analysis was conducted using descriptive and inferential statistics, and the effect of the educational program was measured by paired sample t-test.

Results: The results indicated a significant increase in the mean knowledge score regarding diabetic foot ulcers, from a pretest score of 8.07±3.5 to a posttest score of 22.1±2.4 ($p<0.001$). Similarly, the mean score for preventive practices increased from 0.86±0.26 in the pretest to 1.99±0.28 in the posttest, which is also statistically significant ($p<0.001$).

Conclusion: The educational program was effective in enhancing both knowledge and preventive practices related to diabetic foot ulcers among diabetic patients in Bangladesh. These findings suggest the need to develop standard, rational foot ulcer prevention guidelines for diabetic patients, contributing to better management and reduction of DFU incidence.

Keywords: Educational program, knowledge, preventive practice, diabetic foot ulcer, Bangladesh

Introduction:

Diabetes mellitus stands as a pervasive metabolic disorder, characterized by insufficient insulin production or ineffective insulin utilization, resulting in elevated blood sugar levels and a myriad of associated symptoms (World Health Organization, 2023). Among its numerous complications, diabetic foot ulceration emerges as a significant concern, posing substantial health risks to affected individuals. Such ulcers, often occurring due to poor glycemic control, manifest as deep wounds in weight-bearing areas below the ankle (Raja et al., 2023). With a global prevalence projected to escalate substantially in the coming decades, diabetes and its complications demand urgent attention as a public health priority (Ong et al., 2023)

In Bangladesh, the burden of diabetes is particularly pronounced, with a notable surge observed in recent years (Rahman et al., 2022; Chowdhury et al., 2022). Alarmingly, a substantial proportion of diabetic patients in the country are susceptible to foot ulcers, further exacerbating the health crisis (Banik et al., 2020). Despite this escalating prevalence, there remains a

significant gap between awareness and preventive practices among diabetic individuals, as evidenced by prior studies (Monami et al., 2015; Zhang et al., 2017).

Educational interventions have emerged as pivotal tools in addressing this disparity, offering avenues to enhance patient knowledge and promote proactive preventive measures (Woodbury et al., 2012). However, the efficacy of such programs in the context of diabetic foot ulcer prevention in Bangladesh remains underexplored. Existing studies have primarily focused on prevalence and rudimentary knowledge assessment, highlighting the need for comprehensive interventions targeting preventive practices (Muhammad-Lutfi et al., 2014; Kumar et al., 2023).

Thus, this study aimed to bridge this gap by investigating the impact of an educational program on both knowledge enhancement and adoption of preventive practices among diabetic patients in Bangladesh. By evaluating the effectiveness of such interventions, this research endeavors to contribute towards the development of standardized guidelines for foot ulcer prevention, benefiting both patients and healthcare providers alike.

Methodology:

A quasi-experimental one-group pre-test and post-test design was employed to evaluate the effectiveness of an educational program on knowledge and preventive practices regarding foot ulcers among diabetic patients in Bangladesh.

Sample size calculation was performed using G*Power analysis, considering a mean difference between two dependent means (matched paired t-test) based on a previous study (Rahman et al., 2018) with a medium effect size of 0.5, significance level $\alpha = 0.05$, and power $(1-\beta) = 0.80$. Consequently, the calculated sample size was determined to be 34. To account for potential attrition, an additional 20% of participants were added, resulting in a final sample size of 42. The target population comprised all diabetic patients residing in Galachipa upazila, Patuakhali, with the accessible population being adult diabetic patients attending the Upazila Health Complex, Galachipa. Convenient sampling was utilized to select 42 diabetic patients from the pool of approximately 150 patients seeking medical services daily at the health complex. Inclusion criteria encompassed patients suffering from diabetes mellitus who were interested in participating, while exclusion criteria included those who had undergone amputation due to diabetic foot ulcers, received previous training on diabetic foot ulcers, or were healthcare professionals with diabetes.

The intervention program, based on the 2019 practical guidelines of the International Working Group on the Diabetic Foot (IWGDF), aimed to educate diabetic patients on foot ulcer prevention. It comprised three lessons: an overview of diabetes and diabetic foot ulcers, diabetic foot assessment and preventive care, and practical demonstrations of preventive practices. Each lesson had allocated time sessions, with 40 minutes for the first two sessions and a 30-minute demonstration following a 10-minute break. Initially developed in English, the material was later translated into Bengali. The intervention spanned two weeks, starting the day after baseline data collection, and consisted of face-to-face group sessions tailored to participants' schedules. Communication with participants was facilitated via phone calls, and verbal permission was obtained before implementing the intervention. Various methods, including theoretical sessions, discussions, leaflets, videos, and practical demonstrations, were utilized to deliver the intervention. Pre-testing was conducted to establish baseline data, with participants selected based on agreement and informed consent. Intervention procedures commenced on the same day as baseline data collection, with participants divided into six groups for the six intervention days. The study setting was well-equipped with multimedia and

sound systems to enhance the program's effectiveness. Post-test data collection occurred 14 days after the intervention, utilizing the same questionnaire administered during pre-testing to assess changes in knowledge and practices regarding diabetic foot ulcers.

The instrument consisted of three parts: a demographic characteristics questionnaire (DCQ-DP), a knowledge-related questionnaire about diabetic foot ulcers (KQ-DFU), and a preventive practice-related questionnaire about diabetic foot ulcers (PPQ-DFU). Content validity was established through expert evaluation, and reliability was assessed using Kuder-Richardson and ICC methods.

Data collection commenced after obtaining approval from the Institutional Review Board (IRB) of the National Institute of Advanced Nursing Education and Research (NIANER) and written consent from participants. Pre-test data were collected, followed by the intervention on the same day. Post-test data were collected after 14 days. A brochure was provided to participants for reference. Data were analyzed using SPSS version 26, employing descriptive and inferential statistics including frequency, percentage, mean, median, standard deviation, independent t-test, ANOVA, Pearson's correlation, and matched pair t-test. Statistical significance was set at $p < 0.05$ for all analyses.

Results:

This chapter presents the findings related to the main variables such as 1) the socio-demographic and clinical characteristics of the patients, 2) the distribution of patients' knowledge about diabetic foot ulcers (DFU), 3) the study respondents' preventive practices for diabetic foot ulcers (DFU), 4) the relationship between socio-demographic and clinical/health-related characteristics and the pre-test and post-test knowledge and preventive practices concerning diabetic foot ulcers (DFU) among the patients and 5) the difference between the pre-test and post-test knowledge and preventive practices about diabetic foot ulcers (DFU).

Table 1 shows that this study sample comprised 42 diabetic patients with a mean age of 56.14 years (SD = 11.2), ranging from 32 to 81 years. The majority of participants were aged 45-60 years (50.0%), followed by those over 60 years (33.3%), and those under 45 years (16.7%). Men constituted 59.5% of the sample, while women made up 40.5%. Most participants were married (88.1%), with a small proportion being widowed (11.9%). Educational levels varied, with nearly half having primary education (47.6%), followed by SSC (28.6%), non-formal education (11.9%), and HSC or above (11.9%). The predominant religion was Islam (76.2%), and 23.8% were Hindu. Regarding occupation, 40.5% were unemployed, 31.0% were farmers, 16.7% were merchants, and 11.9% were service holders. The monthly income mainly fell within the middle class range (61.9%), with 23.8% in the lower class and 14.3% in the upper class. The average income was 12,700 BDT (SD = 6236.26), ranging from 5000 to 37000 BDT.

In terms of health characteristics, the duration of diabetes varied, with 57.1% having diabetes for 1-5 years, 38.1% for 6-10 years, and 4.8% for 11-15 years. Family history of diabetes was common, particularly among brothers (64.3%) and sisters (33.3%). Most participants were on oral medication (71.4%), with a minority using insulin (28.6%). All participants had type 2 diabetes, with 59.5% being overweight (BMI $\geq$ 25.0) and 40.5% having a normal weight (BMI 18.5-24.9). Random blood sugar levels were controlled in 90.5% (5-10 mmol/L). Blood pressure readings indicated that 54.8% had normal systolic pressure (>120 mmHg), while 45.2% had stage 1 hypertension (130-139 mmHg). For diastolic pressure, 69.0% had normal levels (>80 mmHg) and 31.0% had stage 1 hypertension (80-89 mmHg). Risk factors for

developing diabetic foot ulcers included poor vision (76.2%), foot deformity (35.7%), neuropathy (26.2%), walking barefoot, and cracked feet (16.7%).

Table 1: The distribution of socio-demographic and health related characteristics of study participants (N=42)

Characteristics	Categories	Response	
		N	%
Age (years)	<45	7	16.7
	45-60	21	50.0
	>60	14	33.3
	(Min= 32, Max= 81, M= 56.14, SD= 11.2)		
Gender	Male	25	59.5
	Female	17	40.5
Marital Status	Married	37	88.1
	Widow	5	11.9
Highest Educational Level	Non-formal education	5	11.9
	Primary education	20	47.6
	SSC	12	28.6
	HSC and above	5	11.9
Religion	Muslim	32	76.2
	Hindu	10	23.8
Occupation	Unemployed	17	40.5
	Farmer	13	31.0
	Service holder	5	11.9
	Merchant	7	16.7
Monthly income	Lower class <12500	10	23.8
	Middle class 12500-21000	26	61.9
	Upper class >21000	6	14.3
	(Min= 5000, Max= 37000, M= 12700, SD= 6236.26)		
Duration of Diabetes Mellitus	1-5 years	24	57.1
	6-10 years	16	38.1
	11-15 years	2	4.8
	Father	2	4.8

Family history of Diabetes Mellitus (Check all that apply)	Mother	4	9.5
	Sister	14	33.3
	Brother	27	64.3
	Others (Paternal and maternal relatives)	8	19.0
Type of medication consumed for diabetes	Insulin	12	28.6
	Oral tablet	30	71.4
Clinical / Health Related Characteristics			
Type of Diabetes Mellitus	Type 1	0	00.0
	Type 2	42	100.0
BMI of Participants	18.5-24.9 (Normal weight)	17	40.5
	≥25.0 (Overweight)	25	59.5
Random Blood Sugar	5-10 mmol/L	38	90.5
	<10 mmol/L	4	9.5
Systolic Blood Pressure (mmHg)	>120 (Normal)	23	54.8
	130-139 (Hypertension stage 1)	19	45.2
Diastolic Blood Pressure (mmHg)	>80 (Normal)	29	69.0
	80-89 (Hypertension stage 1)	13	31.0
Having risk factor developing diabetic foot ulcer (Check all that apply)	Neuropathy	11	26.2
	Poor vision	32	76.2
	Absent of dorsalis Pedis pulsation	3	7.1
	Foot deformity	15	35.7
	Others (walk in bare foot and crack)	7	16.7

Table 2 illustrates the pre-test and post-test knowledge regarding diabetic foot ulcers (DFU) among patients (n=42). Initially, knowledge was low across various aspects; for instance, only 7.1% of participants knew that diabetes affects every organ (M=0.07, SD=0.26) before the intervention, which surged to 92.9% (M=0.93, SD=0.26) after. Similarly, understanding that diabetes causes hardening of blood vessels rose from 11.9% (M=0.12, SD=0.32) pre-test to 78.6% (M=0.79, SD=0.41) post-test.

Knowledge about neuropathy as a common consequence of diabetes increased from 47.6% (M=0.48, SD=0.50) to 92.9% (M=0.93, SD=0.26), and awareness that high blood sugar cannot

uplift nerve activity improved from 33.3% (M=0.33, SD=0.47) to 83.3% (M=0.83, SD=0.37). Participants' understanding that foot ulcers can lead to gangrene also improved markedly, from 26.2% (M=0.26, SD=0.44) to 71.4% (M=0.71, SD=0.45).

Furthermore, the knowledge about daily inspection and examination of feet as a preventive measure increased from 57.1% (M=0.57, SD=0.50) to 97.6% (M=0.98, SD=0.15), and awareness of the importance of washing feet daily and patting them dry rose from 71.4% (M=0.71, SD=0.45) to 92.9% (M=0.93, SD=0.26). Overall, the mean knowledge score increased significantly from 8.07 (SD=3.5) pre-test to 22.1 (SD=2.4) post-test.

Table 2: Distribution of study subjects according to diabetic foot ulcers (DFU) knowledge (n=42)

Variables	Pre-test			Post-test		
	Correct			Correct		
	n	%	M±SD	n	%	M±SD
Diabetes affects every organ.	3	7.1	.07±.26	39	92.9	.93±.26
Blood flow may increase to the feet in case of diabetes.	24	57.1	.57±.50	39	92.9	.93±.26
Diabetes cause hardening of the blood vessel.	5	11.9	.12±.32	33	78.6	.79±.41
High blood sugar cannot uplift nerve activity.	14	33.3	.33±.47	35	83.3	.83±.37
Neuropathy is common consequence of diabetes.	20	47.6	.48±.50	39	92.9	.93±.26
Feet may feel cold, tingle or numb in case of neuropathy.	13	31	.31±.46	36	85.7	.86±.35
1 in 3 patients with diabetes develop foot ulcer in their lifetime.	11	26.2	.26±.44	40	95.2	.95±.21
Foot ulcer caused by vascular sufficiency.	4	9.5	.10±.29	37	88.1	.88±.32
Ulcer on foot can develop gangrene.	11	26.2	.26±.44	30	71.4	.71±.45
45 and older male diabetic patients are risk free for foot ulcer.	6	14.3	.14±.35	34	81	.81±.39
Loss of protective sensation in foot can develop foot ulcer.	30	71.4	.71±.45	35	83.3	.83±.37

Blister, Corn and Callus formation is warning sign of developing foot ulcer.	14	33.3	.33±.47	39	92.9	.93±.26
Foot infections begin mostly from webbed spaces.	5	11.9	.12±.32	40	95.2	.95±.21
Flat feet can cause pressure areas which are more likely to have skin breakdown.	3	7.1	.07±.26	38	90.5	.90±.29
Foot deformity and callus formation resulting in focal areas of high pressure.	18	42.9	.43±.50	39	92.9	.93±.26
Infected foot may be in red color, swelled, cold to touch.	24	57.1	.43±.50	35	83.3	.83±.37
Foot ulcer develops cause swelling, itching and a burning sensation.	6	14.3	.14±.35	40	95.2	.95±.21
Gangrene is the death of tissue due to lack of blood flow.	6	14.3	.14±.35	37	88.1	.88±.32
Gangrene commonly affects the toes.	29	69	.69±.46	38	90.5	.90±.29
Foot amputation is done due to gangrene.	3	7.1	.07±.26	37	88.1	.88±.32
Patient with diabetes should undergo for foot screening in every 1-3 months.	4	9.5	.10±.29	32	76.2	.76±.43
Body weight and Proper glycemic control can prevent foot ulcer.	22	52.4	.52±.50	36	85.7	.86±.35
Washing feet daily and pat dry carefully is the preventive practice of ulcer formation in feet.	30	71.4	.71±.45	39	92.9	.93±.26
Inspection and examination of feet daily is the preventive practice of ulcer formation in feet.	24	57.1	.57±.50	41	97.6	.98±.15
Wearing comfortable shoes is the preventive practice of ulcer formation in feet.	14	33.3	.33±.47	40	95.2	.95±.21
Total M±SD			8.07±3.5			22.1±2.4

The Table 3 highlights the pre-test and post-test preventive practices related to diabetic foot ulcers (DFU) among the study subjects (N=42). Before the intervention, participants demonstrated inconsistent practices, with many reporting seldom or never engaging in key preventive behaviors. For instance, only 2.4% reported always washing and patting dry their feet pre-test, but this increased to 61.9% post-test, with a mean score of 1±0.54 pre-test rising to 2±0.62 post-test, indicating a substantial enhancement in this practice. Similarly, attention to dry spaces between toes improved from 45.2% to 59.5% post-test, with a mean score increasing from 0.55±0.5 to 1.98±0.64.

The frequency of walking barefoot decreased significantly post-intervention, with 28.6% reporting often or always compared to 69.5% pre-test. Notably, many participants began regularly examining their feet for sensation, with 64.3% reporting often or always post-test

compared to only 4.8% pre-test, resulting in a notable increase in mean score from 0.24±0.53 to 1.74±0.66. Moreover, the utilization of preventive tools such as pumice stone and gentle pressure for dead skin removal saw significant adoption post-intervention, with mean scores rising from 0.17±0.43 to 2.10±0.61 and from 0.29±0.55 to 2.29±0.50, respectively. Overall, the total mean score increased from 0.86±0.26 pre-test to 1.99±0.28 post-test.

Table 3: Distribution of study subjects according to Diabetic Foot Ulcers (DFU) related Preventive Practice (N=42)

Characteristics	Pre-test					Post-test				
	Never	Seldom	Often	Always	M±SD	Never	Seldom	Often	Always	M±SD
	n (%)	n (%)	n (%)	n (%)		n (%)	n (%)	n (%)	n (%)	
I wash and pat dry my feet.	5 (11.9)	33 (78.6)	3 (7.1)	1 (2.4)	1±.54	-	8 (19)	26 (61.9)	8 (19)	2±.62
I pay special attention to dry the spaces between toes.	19 (45.2)	23 (54.8)	-	-	.55±.5	-	9 (21.4)	25 (59.5)	8 (19)	1.98±.64
I walk in barefoot frequently.	9 (21.4)	10 (23.8)	11 (26.2)	12 (28.6)	1.38±1.125	6 (14.3)	17 (40.5)	17 (40.5)	2 (4.8)	1.64±.79
I wear well fitted foot wear both indoors and outdoors.	9 (21.4)	15 (35.7)	16 (38.1)	2 (4.8)	1.26±.85	-	2 (4.8)	28 (66.7)	12 (28.6)	2.24±.53
I check my skin color.	14 (33.3)	14 (33.3)	13 (31)	1 (2.4)	1.02±.86	2 (4.8)	3 (7.1)	32 (76.2)	5 (11.9)	1.95±.62
I check thickness, dryness and cracking of skin of feet.	22 (52.4)	13 (31)	5 (11.9)	2 (4.8)	.69±.86	1 (2.4)	2 (4.8)	28 (66.7)	11 (26.2)	2.17±.62
I check for corns and callus.	12 (28.6)	19 (45.2)	9 (21.4)	2 (4.8)	1.02±.84	2 (4.8)	5 (11.9)	21 (50)	14 (33.3)	2.12±.80
I check between toes for blister.	33 (78.6)	5 (11.9)	3 (7.1)	1 (2.4)	.33±.72	2 (4.8)	4 (9.5)	24 (57.1)	12 (28.6)	2.1±.75

Table 3 Continue

Items	Pre-test					Post-test				
	Never	**Seldom**	**Often**	**Always**	**M±SD**	**Never**	**Seldom**	**Often**	**Always**	**M±SD**
	n (%)	**n (%)**	**n (%)**	**n (%)**		**n (%)**	**n (%)**	**n (%)**	**n (%)**	
I check any muscle wasting over bony prominences.	26 (61.9)	11 (26.2)	5 (11.9)	-	.50±.7	2 (4.8)	3 (7.1)	33 (78.6)	4 (9.5)	1.93±.60
I examine my feet for checking sensation.	34 (81)	6 (14.3)	2 (4.8)	-	.24±.53	2 (4.8)	10 (23.8)	27 (64.3)	3 (7.1)	1.74±.66
I check my blood pressure regularly.	3 (7.1)	25 (59.5)	12 (28.6)	2 (4.8)	1.31±.68	1 (2.4)	3 (7.1)	25 (59.5)	13 (31)	2.19±.67
I cut nails in oval shape, rounding the corners and make it too short.	6 (14.3)	24 (57.1)	9 (21.4)	3 (7.1)	1.79±.78	4 (9.5)	23 (54.8)	15 (35.7)	-	1.74±.62
I file nails in two direction to make edge smooth.	7 (16.7)	24 (57.1)	9 (21.4)	2 (4.8)	1.86±.75	3 (7.1)	23 (54.8)	15 (35.7)	1 (2.4)	1.67±.65
I soak feet daily until the skin softens.	28 (66.7)	11 (26.2)	3 (7.1)	-	.40±.62	-	3 (7.1)	35 (83.3)	4 (9.5)	2.02±.41
I use pumice stone to file the corn.	36 (85.7)	5 (11.9)	1 (2.4)	-	.17±.43	2 (4.8)	-	32 (76.2)	8 (19)	2.10±.61
I apply gentle pressure with circular or sideways motions to remove dead skin.	32 (76.2)	8 (19)	2 (4.8)	-	.29±.55	-	1 (2.4)	28 (66.7)	13 (31)	2.29±.50
Total M±SD					.86±.26					1.99±.28

The pretest was conducted before implementing the educational program to assess the impact of potential variables, while the posttest was conducted afterward to evaluate the program's effectiveness. Table-4 depicts the correlation between patients' pre-test and post-test knowledge and preventive practice scores on Diabetic Foot Ulcers (DFU). The findings revealed that the socio-demographic and clinical/health related characteristics of patients generally did not show any significant association with the pretest knowledge score concerning DFU, except for the highest educational level. Specifically, patients who had completed their Secondary School Certificate (S.S.C) demonstrated a statistically significant ($p=0.05$) higher pretest knowledge score regarding DFU. However, there was no discernible relationship observed between the highest educational level and preventive practices in the pretest phase among patients.

Table 4: The Relationship among Socio-demographic, Clinical/Health related Characteristics and Pre-Posttest Knowledge and Preventive Practice of Diabetic Foot Ulcers (DFU) among Patients (N=42)

Characteristics	Categories	Pre-test				Post-test			
		DFU Knowledge		Preventive Practice		DFU Knowledge		Preventive Practice	
		M±SD	r/F/t (*p*)	M±SD	r/F/t (*p*)	M±SD	r/F/t (*p*)	M±SD	r/F/t (*p*)
Age	..	..	-.02 (.89)	..	-.23 (.13)	..	.24 (.12)	..	-.01 (.93)
Gender	Male	8.48±3.3	.93 (.36)	.77±.22	2.9 (.7)	22.6±1.8	1.7 (.1)	1.94±.24	1.2 (.35)
	Female	7.5±3.8		.99±.26		21.35±3		2.1±.34	
Marital Status	Married	8.32±3.4	1.3 (.8)	.85±.26	.68 (.5)	22.16±2.5	.48 (.63)	1.97±.29	1.02 (.31)
	Widow	6.2±3.9		.94±.32		21.6±1.5		2.11±.14	
Highest Educational Level	No formal education	5.80±3.8	4.9 (.005)	.79±.36	.53 (.67)	23.2±1.1	.97 (.4)	2.01±.15	1.7 (.2)
	Primary education	6.9±3.1		.83±.28		21.6±1.9		2.04±.24	
	SSC	10.6±2.6		.92±.21		22±3.8		1.8±.32	
	HSC and above	8.1±3.5		.94±.19		23.2±2.5		2.11±.37	
Religion	Muslim	7.6±3.7	1.5 (.14)	.87±.27	.44 (.7)	22.4±1.8	1.5 (.14)	2.1±.26	1.1 (.3)
	Hindu	9.5±2.2		.83±.22		21.1±3.8		1.9±.36	
Occupation	Unemployed	7.5±3.7	1.2 (.34)	.88±.29	.96 (.42)	21.94±1.8	.56 (.65)	2.1±.28	.79 (.5)
	Farmer	7.4±3.5		.78±.24		21.62±3.4		1.94±.16	
	Service	10.4±2.3		1±.14		23±2.6		1.9±.53	
	Merchant	8.9±3.3		.87±.24		22.7±2.4		1.9±.28	

Table 4 (Continue.)

Characteristics	Categories	Pre-test				Post-test			
		DFU Knowledge		Preventive Practice		DFU Knowledge		Preventive Practice	
		M±SD	r/F/t (*p*)	M±SD	r/F/t (*p*)	M±SD	r/F/t (*p*)	M±SD	r/F/t (*p*)
Monthly income	Lower class <12500	8.10±3.2	.49 (.62)	.85±.25	.2 (.8)	22.2±1.7	.6 (.5)	1.9±.24	1.2 (.3)
	Middle class 12500-21000	7.8±3.7		.85±.29		21.9±2.7		2±.26	
	Upper class >21000	9.33±2.7		.92±.16		23±2.2		1.8±.43	
	11-15 years	4.5±.7		.62±.27		24±.1		1.9±.35	
Family History of DM	Father	7±.7	.2 (.7)	1.2±.3	3.4 (.07)	23±.7	.7 (.4)	2±.3	.27 (.6)
	Mother	7±4	.4 (.5)	.94±.22	.4 (.5)	20±5	1.4 (.2)	1.8±.4	2.5 (.12)
	Sister	10.1±3.4	8 (.5)	.86±.26	.01 (.9)	22.1±1.9	9.9 (.5)	1.9±.4	.3 (.5)
	Brother	7.8±3.4	.41 (.5)	.9±.3	1.6 (.2)	22.3±1.8	.9 (.3)	2±.28	5.7 (.02)
	Others	8.5±2	.15 (.7)	.8±.2	.4 (.5)	21.5±2.2	.6 (.4)	1.9±.3	.1 (.7)
	None	6.5±3.4	.9 (.3)	.8±.2	.8 (.3)	22±1.8	.007 (.9)	1.9±.04	.4 (.5)
Medication for DM	Insulin	7.7±3.8	.47 (.6)	.96±.32		22.8±1.5	1.3 (.2)	2.05±.41	.88 (.4)
	Oral tablet	8.2±3.4		.82±.22	1.6 (.1)	21.8±2.7		1.9±.21	
BMI of Participants	18.5-24.9 (Normal weight)	7.1±3.5	1.7 (.2)	.95±.27	1.8 (.2)	21.8±1.9	.32 (.7)	1.97±.37	.5 (.6)
	≥25.0 (Overweight)	9.1±3.4		.8±.25		22.2±2.7		1.98±.22	

Table 4 (Continue.)

Characteristics	Categories	Pre-test				Post-test			
		DFU Knowledge		Preventive Practice		DFU Knowledge		Preventive Practice	
		M±SD	r/F/t (*p*)	M±SD	r/F/t (*p*)	M±SD	r/F/t (*p*)	M±SD	r/F/t (*p*)
Random Blood Sugar	5-10 mmol/L	7.71±3.4	2.1 (.03)	.86±.27	.6 (.5)	21.9±2.5	1 (.3)	2±.25	1.3 (.12)
	<10 mmol/L	11.5±1.2		.94±.23		23.3±1.5		1.8±.52	
Systolic & Diastolic Pressure	>120 (Normal)	7.1±3.5	1.9 (.06)	21.8±2.8	.56 (.5)	.84±.26	.41 (.6)	2±.24	.56 (.5)
	130-139 (Hypertension stage 1)	9.1±3		22.3±1.8		.88±.26		1.9±.32	
Diastolic Blood Pressure (mmHg)	>80 (Normal)	7.7±3.6	.8 (.3)	14.4±4.4	1.5 (.1)	.9±.27	1.5 (.1)	2±.22	.3 (.7)
	80-89 (Hypertension stage 1)	8.7±3		12.3±3.1		.76±.19		1.9±.38	
Presence of risk factor for developing diabetic foot ulcer	Neuropathy	8.82±.27	.7 (.4)	.97±.27	2.3 (.1)	22.5±1.6	.5 (.4)	1.9±.3	3.8 (.05)
	Poor vision	8.1±3.5	.001 (.97)	.92±.25	7.9 (.007)	21.9±2.6	.6 (.5)	2.01±.29	1.2 (.3)
	Absent of dorsalis Pedis pulsation	10.33±.6	1.4 (.2)	.60±.09	3.4 (.07)	22.3±1.5	.03 (.86)	1.7±.22	2.4 (.12)
	Foot deformity	8.8±2.7	1 (.3)	.85±.25	.02 (.9)	22.5±1.7	.8 (.3)	2.1±.25	4.3 (.04)
	Others	8.14±3.5	.003 (.9)	.69±.23	3.6 (.06)	22.7±1.6	.5 (.4)	2±.24	.2 (.7)

The table 5 presents the differences between pretest and posttest scores for Diabetic Foot Ulcers (DFU) knowledge and preventive practices among patients (N=42). Before the educational intervention, the mean score for DFU knowledge was 8.07 (±3.5), which significantly increased to 22.1 (±2.4) post-intervention. This change resulted in a mean difference of 14.03 (±1.1), with a highly significant t-value of 24.61 ($p < .001$), indicating a substantial improvement in DFU knowledge following the intervention. Similarly, the preventive practices for DFU also saw significant enhancement. The mean score increased from 0.86 (±0.26) in the pretest to 1.99 (±0.28) in the posttest, reflecting a mean difference of 1.13 (±0.02). The t-value of 21.784 was highly significant ($p < .001$), demonstrating a considerable improvement in preventive practices after the educational intervention.

Table 5: Differences between pretest and posttest Diabetic Foot Ulcers (DFU) Knowledge and Preventive Practices of patients (N=42)

Variables	**Pre-test**	**Post-test**	**Mean Difference (dx± SD)**	**t**	***p*-value**
	M±SD	**M±SD**			
DFU Knowledge	8.07±3.5	22.1±2.4	14.03±1.1	24.61	< .001
DFU Preventive Practices	.86±.26	1.99±.28	1.13±.02	21.784	< .001

Discussion:

The purpose of this study was to examine the effectiveness of an educational program on knowledge and preventive practices regarding diabetic foot ulcers among diabetic patients in Bangladesh. The findings of this study are discussed below, encompassing socio-demographic and clinical characteristics of patients, the relationship between these characteristics and pre- and post-test knowledge and practices, and the overall impact of the educational program.

Socio-Demographic and Clinical Characteristics of Patients

The present study revealed that the mean age of diabetic patients was 56.14±11.2 years, ranging from 32 to 81 years. This finding aligns with other studies in Bangladesh and Ethiopia, indicating that diabetes predominantly affects middle-aged adults (Alom, 2023; Tantigegn, 2023). The World Health Organization attributes the increasing number of older adults to improved life expectancy, noting that aging impairs carbohydrate metabolism, thereby elevating diabetes risk. Insufficient insulin secretion is a significant factor in hyperglycemia among the elderly (Mordarska et al., 2017).

All participants in the study had type 2 diabetes mellitus, which can be mitigated through regular physical activity, moderate alcohol consumption, smoking cessation, a healthy diet, and maintaining a healthy weight (Glauber & Karnieli, 2013). Most patients were Muslim, reflecting Bangladesh's religious demographics, and a majority were married, correlating with the prevalence of diabetes among the elderly.

Educational attainment among participants was relatively high, with 47.6% having completed primary education and only 11.9% lacking formal education, reflecting increasing literacy rates in Bangladesh (Bangladesh Bureau of Statistics, 2023). Studies indicate a positive correlation between education and diabetes self-care (Lamb et al., 2021; Arokiasamy et al., 2021). Most patients were unemployed, likely due to age and retirement, consistent with findings that diabetes diagnoses often occur during individuals' work-loss years (von Bonsdorff et al., 2018). Nearly half of the patients were farmers, contradicting some studies that suggest lower diabetes prevalence among farmers due to high physical activity (Thelin and Holmberg ,2014; Velmurugan et al., 2021).

The average monthly family income was 12,700±6,236.26 BDT, with more than half of the patients belonging to middle-class families, which have been shown to achieve better glycemic control than lower-class families (Ahsan et al., 2022). Diabetes prevalence is higher in middle- and low-income countries, particularly in rural areas (World Health Organization, 2023), likely due to limited access to resources supporting proper nutrition and routine checkups (Auchincloss et al., 2009). Non-pharmacological interventions, such as exercise, weight loss, lifestyle modification, and proper meal plans, are recommended for preventing type 2 diabetes mellitus (Sarker et al., 2020).

Regarding co-morbidities, 76.2% of patients suffered from poor vision, 35.7% from foot deformities, and 26.2% from neuropathy. These findings are consistent with the Bangladesh Population-Based Diabetes and Eye Study, which reported high rates of cataracts, trachoma, pterygium, and glaucoma among diabetics (Islam et al., 2015). Vision impairment is often due to damage to the tiny blood vessels in the retina caused by high blood sugar levels (CDC, 2023). Neuropathy and foot deformities significantly increase the risk of foot ulcers, infections, gangrene, and amputations (Al-Rubeaan et al., 2015; Haque et al., 2023). Lifestyle modifications, including diet, exercise, and regular foot care, can help prevent these complications (ElSayed et al., 2023).

Relationship among Socio-Demographic, Clinical/Health Characteristics and Pre-Posttest Knowledge and Preventive Practices

The study found that socio-demographic characteristics, except for the highest educational level, were not significantly associated with pre-test knowledge scores regarding diabetic foot ulcers. Patients with a higher education level (passed S.S.C) had significantly better pre-test knowledge (p=.05). However, there was no significant relationship between the highest educational level and preventive practices in the pre-test. This suggests that while basic education improves knowledge, practical experiences and targeted educational interventions are necessary to enhance preventive practices.

A pre-post quasi-experimental study in Dehradun also found that occupation had a significant association with pre-test knowledge, while other variables such as gender, age, family history, and smoking habits did not (Sehrawat et al., 2018). Increasing awareness and participation in educational events could further enhance knowledge and skills to manage diabetes (Akter et al., 2022).

Effect of Educational Program on Diabetic Foot Ulcers (DFU) Knowledge

The study demonstrated a significant improvement in patients' knowledge following the educational program, with mean pre-test knowledge scores increasing from 8.07±3.5 to 22.1±2.4 post-test. This finding is consistent with an open-label randomized controlled trial in New Delhi, which showed a significant increase in knowledge scores in the intervention group (Monami et al., 2015). Similar results were observed in a study in Puducherry, India, where structured teaching significantly improved patients' knowledge about foot care (Saurabh et al., 2014). Educational programs effectively enhance both theoretical understanding and practical skills, contributing to better management of diabetic foot care (Moraes et al., 2020; Jeihooni et al., 2019).

Effect of Educational Program on Diabetic Foot Ulcers (DFU) Preventive Practices

The educational program also significantly improved preventive practices, with mean scores increasing from .86±.26 to 1.99±.28 post-interventions. This result aligns with findings from a randomized controlled trial in Florence, which demonstrated the effectiveness of educational programs in preventing diabetic foot ulcers in high-risk patients (Monami et al., 2015). A study in Pakistan similarly showed that educational interventions improved preventive practices among nurses (Ramzan et al., 2022). These findings highlight the importance of regular educational programs to promote self-management and preventive practices among diabetic patients.

Differences between Pretest and Posttest Diabetic Foot Ulcers (DFU) Knowledge and Preventive Practices

The study revealed statistically significant improvements in both knowledge and preventive practices regarding diabetic foot ulcers post-intervention. The mean knowledge score increased from 8.07±3.5 to 22.1±2.4, and the mean preventive practice score increased from .86±.26 to 1.99±.28, both with p-values < .001. These results are consistent with other studies showing significant improvements in knowledge and practices following educational interventions (Rahman et al., 2018; Ramzan et al., 2022).

Overall, the educational program was effective in significantly enhancing knowledge and preventive practices related to diabetic foot ulcers. This underscores the critical role of education in managing diabetes and preventing complications. Regular educational programs and continuous support for diabetic patients are recommended to sustain and further improve these outcomes (Saurabh et al., 2014; Jeihooni et al., 2019).

Limitations:

Despite its significant findings, this study has several limitations that should be acknowledged. Firstly, the study utilized a quasi-experimental one-group pretest-posttest design, which lacks a control group for comparison, potentially limiting the robustness of the conclusions. Secondly, the sample size was relatively small and confined to a single health complex in Galachipa, Patuakhali, which may limit the generalizability of the results to other regions or populations in Bangladesh. Additionally, the study relied on self-reported data for measuring knowledge and preventive practices, which may be subject to response bias or inaccuracies. The duration of the study was also relatively short, which may not capture long-term effects of the educational program on diabetic foot ulcer prevention. Lastly, external factors such as socio-economic status, access to healthcare, and individual variations in learning and implementing preventive practices were not controlled, which could influence the outcomes. Future studies should consider addressing these limitations by incorporating a larger, more diverse sample, utilizing a randomized controlled trial design, and extending the follow-up period to assess long-term impacts.

Conclusion:

A quasi-experimental one-group pretest-posttest study was conducted from January 2023 to December 2023 at Upazila Health Complex, Galachipa, Patuakhali. The study aimed to evaluate the effectiveness of an educational program on knowledge and preventive practices concerning diabetic foot ulcers among diabetic patients. The findings indicate that the educational program significantly improved both knowledge and preventive practices related to diabetic foot ulcers among the participants. Consequently, the study's objective was met, and the research hypothesis was validated. Notably, this is the first study in Bangladesh to assess the impact of an educational program on knowledge and preventive practices for diabetic foot ulcers among diabetic patients.

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