

Effectiveness Of Foot Care Practice Tool On Diabetes Control Among Diabetic Patients With Risk For Foot Ulcers In South India

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Abstract

Introduction: Diabetic foot ulcer (DFU) is very susceptible to infection, which rapidly spreads in the foot and ultimately leads to amputation. Diabetic foot infection (DFI) is a serious threat to public health around the world because it can lead to death. The aim of this study was to design a foot care practice tool and evaluate the effectiveness on diabetics in terms of knowledge, skill and hemoglobin A1c.

Methods: An experimental pretest - posttest study design was used for this study. A total of 200 diabetics participated in this study in which 100 diabetics in the control group and 100 diabetics in the experimental group.

Results: The present study findings show that 48.1 % improvement in foot care knowledge in the experimental group and 7.1% improvement in the control group. Experimental group showed 0.46 % reduction in HbA1C level comparing to a 0.05% reduction in HbA1C in the control group.

Conclusions: This study showed an increase in the foot care knowledge and skill of diabetics after the intervention and drastic reduction in HbA1C in the experimental group compared to the control group. The study conveys a strong message to diabetes health care providers about the critical need for foot care awareness programmes among diabetics.

Key words: Diabetic foot infection, Diabetes mellitus, Diabetic foot ulcer, HbA1c, HPLC, Information Education and Communication

INTRODUCTION

Diabetic foot ulcer (DFU) is very susceptible to infection, which spreads swiftly in the foot and eventually leads to amputation [1]. Diabetic foot infection (DFI) is connected with risk of death and is a major global public health concern. About 50 to 60 percent of DFU may develop into DFI, which has disastrous consequences for diabetic feet [2,3]. The global prevalence of foot complications is 1.77%, with diabetic foot ulcer infection accounting for 95% [4]. The prevalence of diabetes mellitus (DM), particularly type-2 is fast increasing and as per World Health Organization, by 2035 there will be more than 592 million type-2 DM patients in the world [5]. The top three diabetes-prevalence countries in the world are China, India, and the United States of America [6].

In India, 82 million people suffer from diabetes and its complications and DFU can develop in 15% of such diabetic patients [7]. The lifetime risk of having diabetic foot ulcers is 25% among diabetics in India as opposed to 15% globally. Improper foot care habits, walking barefoot, and poor diabetic management are the major factors for such a high percentage [8]. It is essential to educate patients about proper footwear, foot hygiene, and nail care in order to reduce DFI increases in the Indian population. To lower the risk of infection, which might result in mortality, particularly foot care instruction is essential for DFU patients.

The aim of this study was to design a foot care practice tool and evaluate the effectiveness on diabetics in terms of knowledge, skill and hemoglobin A1c (HbA1c).

METHODOLOGY

An experimental pretest-posttest study design was used for this study. Participants who satisfied the inclusion criteria were included in this study and they were either subjected to Intervention (experimental group) or control group.

Inclusion Criteria:

1. Individuals receiving treatment for Type II diabetes mellitus
2. Individuals with risk of diabetic foot assessed with the help of a risk assessment tool
3. Age group between 30-60 years
4. Both gender
5. Duration of illness within 5 years.

Exclusion Criteria:

1. Individuals with physical disability
2. Individuals who had undergone any stress management programme

A total of 200 diabetics participated in this study in which 100 diabetics in the control group and 100 diabetics in the experimental group. Estimated sample size was 91 with power of the study 85% ($\beta = 15\%$) and confidence of result 95% (type I error $\alpha = 5\%$). To allow 10% of dropout rate, a total of 100 patients (100 experiment + 100 control) were included in this study.

The research was conducted after obtaining approval from the Institutional Ethics Committee (IEC) of Saveetha Medical College Hospital (Ref No 001/01/2020/IEC/SMCH). The individuals's data were recorded for 6 months sampling technique was used to select the participants.

FOOT CARE NURSING INTERVENTION TOOL

Section A, IEC package: The Information Education and Communication (IEC) Package on diabetes covered the signs and symptoms, types, complications, dietary management, lifestyle management, and medical management, as well as specific foot complications, the significance of foot care, self-practices of foot care, and management of foot problems. Computer presentation was used to give the education package.

Section B, Foot care practices: Foot care techniques included inspecting the feet, choosing the right shoes and socks, and treating wounds through demonstration and video lectures.

Section C, Foot care Kit: Foot care kit was given to all experimental group participants. The kit included 10gm monofilament, reflex hammer, padding, toe clipper, orthotics, nail cutters, nippers, filers, pumice stone, skin sponge, nail file, scissors, and foot care cream.

Section D, Counselling: Counselling was given to the diabetics and their families, highlighting the importance of foot care and the appropriate use of tool care kit.

DATA COLLECTION TOOLS: Validated questionnaire was used to collect data, which included the following

Section A: Structured interview schedule to assess the demographic and clinical variables such as age, gender, type of family, educational status, occupation, duration of illness, food habits and family history of diabetes,

Section B: Risk assessment tool (A 60 seconds tool: screening for high-risk diabetes foot) to assess the foot risk.

Section C: Structured interview schedule to assess the knowledge on diabetes and foot care

Section D: Modified Nottingham Assessment of Functional Foot-care to assess the foot care practices.

Section E: Blood test to assess HbA1C level using high-performance liquid chromatographic (HPLC) method among participants with diabetes mellitus

DATA COLLECTION METHODS

The demographic data were recorded on the first day, and Pre-test was carried out. The foot care knowledge, skills and HbA1C among individuals with diabetes mellitus for both the control and experimental groups. On the same day, complete foot care packages were given to the experimental group.

Post-test was administered after three and six months later. Knowledge, skills and HbA1C among individuals with diabetes mellitus for control and experimental group were evaluated immediately (post-test1), 3rd month (Post-test 2) and 6 months (post-test3).

STATISTICAL ANALYSIS:

Data was collected and coded, entered and analyzed by the SigmaPlot 14.5 version (Systat Software Inc., St Jose, USA). The knowledge scores were expressed as median and percentiles and analysed by Kruskal Wallis One-way ANOVA on ranks with Tukey's multiple comparison test. Two-way repeated measures analysis of variance with Bonferroni't' test used for multiple comparisons for Pre-tests and Post-tests.

RESULT:

This study included a total of 200 participants with diabetics, in which 100 subjects were in the control group and 100 subjects were in the experimental group. The majority (37%) of the study subjects were aged between 30-40 years in the control group and 51-60 years (45%) in the experimental group.

Table 1: Demographic and variables of the study participants for homogenously

Variables	Category	Control group %	Experimental group %	Statistical analysis
Gender	Male	35	57	P = 0.003
	Female	65	43	
Age (years)	30-40	37	25	P = 0.083
	41-50	32	30	
	51-60	31	45	
Education	Post graduate	30	18	P = 0.100
	Graduate	18	26	
	Schooling	52	56	
Occupation	Professional	29	34	P = 0.591
	Semi-professional	31	25	
	Others	40	41	

Table 1: The above table indicates the demographic variables of the experimental and control group which was selected for homogeneity during the pre-test.

Table 2: Clinical variables of control and experimental groups, pre-test for homogeneity.

Variables	Category	Control group %	Experimental group %	Statistical analysis
Previous ulcer	Yes	0	0	P = 1.0
	No	100	100	
Previous amputation	Yes	0	0	P = 1.0
	No	100	100	
Deformity	Yes	0	0	P = 1.0
	No	100	100	
Pedal pulses	Yes	24	0	P < 0.001
	No	76	100	
Active ulcer	Yes	0	17	P < 0.001
	No	100	83	
Ingrown nail	Yes	36	11	P < 0.001
	No	64	89	
Calluses	Yes	27	20	P = 0.317
	No	73	80	
Blisters	Yes	12	5	P = 0.128
	No	88	95	
Fissures	Yes	0	0	P = 1.0
	No	100	100	
Monofilament	Yes	64	48	P = 0.033
	No	36	52	

Table 2 shows the clinical characteristics of diabetic clients. There is no previous ulcer, previous amputation or deformity found in both the groups. Pedal pulses were 24% in the control group clients, 17% of the clients had an active ulcer in the experimental group, and ingrown nail was present on 36% of the control group and 11% of the experimental group. Calluses was present on 27% in control group and 20% in experimental group. Blisters was present on 12 % of the control group and 5 % of the experimental group. Monofilament was present on 64 % of the control group and 48 % of the experimental group. There is a statistically significant difference between the two groups shown in terms of Pedal pulses, Ingrown nail and Monofilament

Table 3: Comparison of control (Con) and experimental (Exp) groups on Knowledge of pre-test and post-tests

Groups	Median	Percentile	Statistics
Con-Pretest	4	3 – 4.75	H = 100.312 P < 0.001
Con-Posttest 1	4	3 – 4.75	
Con-Posttest 2	4	3 – 4.75	
Con-Posttest 3	4	3 – 9	
Exp-Pretest	4	3 – 4.75	
Exp-Posttest 1	4	3 – 6	
Exp-Posttest 2	8.5	3 – 9.75	
Exp-Posttest 3	9	6 – 10	

Table 3 shows the comparison of control (Con) and experimental (Exp) groups on knowledge of pre-test and post-tests. The median knowledge scores of the Control group -Pretest, Posttest 1, Posttest 2 and Posttest 3 are 4,4,4,4 respectively in the experimental group, Pretest, Posttest 1, Posttest 2 and Posttest 3 are 4, 4, 8.5 and 9. Compared to the respective control groups, Posttest 2 and posttest 3 of the experimental group showed significant improvement in knowledge ($P < 0.001$).

Table 4: Comparison of control (Con) and experimental (Exp) groups on Modified Nottingham assessment scale of pre-test and post-tests

Test	Mean \pm SE	Control	Experimental	Comparison between tests (control and experiment)
Pre-test		33.60 \pm 0.94	33.96 \pm 1.22	t = 0.232; P = 0.817
Post-test 1		33.60 \pm 0.94	35.07 \pm 1.24	t = 0.946; P = 0.345
Post-test 2	Mean \pm SE	34.74 \pm 1.07	47.79 \pm 1.15	t = 8.399; P < 0.001
Post-test 3		35.98 \pm 1.16	50.30 \pm 1.03	t = 9.217; P < 0.001

Table 4 shows the Modified Nottingham assessment scale to access the skill. The mean values of control group pre-test, post-test 1, post-test 2 and post-test 3 are 33.60, 33.60, 34.74 and 35.98, respectively. The mean values of experimental group pre-test, post-test 1, post-test 2 and post-test 3 are 33.96, 35.07, 47.79 and 50.30, respectively. Comparing control and experimental (between groups), the pre-tests and post-tests 1 did not show significance ($P = 0.817$ and $P = 0.345$, respectively). Whereas, the post-tests 2 and post-tests 3, showed significant difference ($P < 0.001$ and $P < 0.001$, respectively). There was a 7.1 % improvement in the control group, but the experimental group showed 48.1 % improvement, showing the effectiveness of the intervention.

Table 5: Comparison of control and experimental groups on HbA1C of pre-test and post-test.

Test	Mean \pm SE	Control	Experimental	Comparison between tests (control and experiment)
Pre-test		7.232 \pm 0.0596	7.518 \pm 0.0741	t=3.007; P=0.003
Post-test 1		7.232 \pm 0.0596	7.518 \pm 0.0741	t=3.007; P<0.003
Post-test 2	Mean \pm SE	7.204 \pm 0.0622	7.001 \pm 0.0719	t=2.049; P<0.043
Post-test 3		7.157 \pm 0.1039	8.027 \pm 0.0788	t=6.679; P<0.000

Table 5 shows the comparison of control and experimental groups on HbA1C of pre-test and post-test. The mean values of the control group pre-test, post-test 1, post-test 2 and post-test 3 are 7.23, 7.23, 7.20 and 7.15 respectively. The mean values of the experimental group pre-test, post-test 1, post-test 2 and post-test 3 are 7.51, 7.51, 7.00 and 8.02, respectively. Comparing control and experimental (between groups), the pre-tests and post-tests 1, 2, and post-tests 3 showed significant difference ($P = 0.003$, $P = 0.003$, $P = 0.043$ and, $P = 0.000$). There was a 0.05% reduction in HbA1C in the control group, but the experimental group showed 0.46 % reduction in HbA1C level, showing the effectiveness of the intervention. Table 5

DISCUSSION

To prevent diabetic foot infections, diabetic patients should practise good foot hygiene. Patients with diabetes need to be constantly aware of the dangerous consequences of foot ulceration and infection. Knowledge and skill in foot self-care practices among diabetic clients are of great significance to prevent diabetic foot ulcers and further complications [9,10]. Foot care knowledge of diabetics is very important for control diabetic infections and further complications [11,12]. The current study compares the pre-test and post-test levels of knowledge and skill of diabetic patients regarding foot care practices, as well as the pre-test and post-test levels of HbA1c. The present study demonstrated that knowledge and skill in foot care practices improved in the experimental group, also there is a significant reduction in HbA1C in the experimental group.

In the present study, there was no statistical difference between the two groups in terms of demographic variables such as age, education, and occupation. There is a statistically significant difference between the two groups shown in terms of Pedal pulses, Ingrown nails and Monofilament.

The present study demonstrates that there is a significant improvement in foot care knowledge of studied diabetics after the intervention. The present study findings show that 48.1 % improvement in foot care knowledge in the experimental group and 7.1% improvement in the control group. This shows a better improvement in foot care knowledge of diabetics after the intervention. When analyzing the participant's HbA1C before and after intervention, a significant reduction in HbA1C was observed in the experimental group compared to the control group. Experimental group showed 0.46 % tremendous reduction in HbA1C level comparing to a 0.05% reduction in HbA1C in the control group. This significant reduction in HbA1C shows the effectiveness of the intervention

A study conducted by Moradi et al, [13] showed that after the foot care intervention, awareness of foot care among diabetic patients in the experiential group improved significantly. The same study also showed a significant reduction in HbA1C in the experimental group.

A study conducted by Hazavehei et al [14] demonstrated that diabetic people need to take caution about their feet. Knowledge in foot care practices of diabetes patients has an influence on avoiding infections. The study further showed that education in diabetic patients regarding foot care was effective.

Another study conducted by KS Kasar et al [15] showed that HbA1c in the experimental group was reduced drastically after intervention. In the study participants of an age of 54 years–According to the results of the the study, there was a statistically significant difference between the pre-post-test in HbA1c.

A study by Adolfsson et al[16] demonstrated that the knowledge of foot care among the intervention group was significantly higher compared to the control group at one-year follow-up.

A study by Abdo et al[17] showed that majority of diabetic patients had low levels of knowledge regarding foot care practices. The study found that knowledge level in foot care was significantly poor among the older age group in the pre-test. After educating such patients, the knowledge was improved drastically and also there was a reduction in the levels of blood sugar and HbA1c.

In a study by Nguyen et al[18] the intervention group significantly improved the knowledge of preventive foot care practices and decreased the prevalence of foot risk factors for foot ulcers.

In a study conducted by Tan et al[19], the intervention group improved their diabetes knowledge ($P = <0.001$) and medication adherence. For within-group comparisons, diabetes knowledge ($P = <0.001$), HbA1c level ($P = <0.001$), Self-monitoring of blood glucose SMBG ($P = <0.001$) and medication adherence ($P = 0.008$) improved from baseline in the intervention group. The study finding advocated the importance of self-foot care practices in diabetes: A study conducted by Zeinab et al[20] demonstrated that knowledge of diabetic foot care practices increased after the intervention. Also, another study by Monami et al [21], Fatehi et al[22], arwa et al[23], Bin Abbas et al[24] and Zareban et al[25], Sriram [26], Vatankhah [27], Otero[28] showed that there is a significant increase in the awareness of the self-foot care practices in diabetes in the experimental group after the intervention.

Diabetes education is assisting the diabetics to understand how to manage diabetes [29]: According to the WHO, diabetes education is essential to diabetes management and is crucial for altering people's behavior and encouraging self-care.

CONCLUSION:

During pre-test, knowledge and skill of diabetics regarding foot self-care practices were poor. A training tool included diabetes mellitus signs and symptoms, types, complications, dietary management, lifestyle management, and medical management. Specific foot complications, significance of foot care, self-practices of foot care, and management of foot problems were also covered. The education package was delivered using computer presentation-

This study showed an increase in the foot care knowledge and skill of diabetics after the intervention and drastic reduction in HbA1C in the experimental group compared to the control group. The study conveys a strong message to diabetes health care providers about the critical need for foot care awareness programmes among diabetics.

CONFLICT OF INTEREST: No

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REFERENCES:

1. Lipsky BA, Berendt AR, Deery HG, Embil JM, Joseph WS, Karchmer AW, LeFrock JL, Lew DP, Mader JT, Norden C, Tan JS. Diagnosis and treatment of diabetic foot infections. *Clinical infectious diseases*. 2004 Oct 1;885-910.
2. Walsh JW, Hoffstad OJ, Sullivan MO, Margolis DJ. Association of diabetic foot ulcer and death in a population-based cohort from the United Kingdom. *Diabet Med* 2016;33:1493-8.
3. Armstrong DG, Boulton AJ, Bus SA. Diabetic foot ulcers and their recurrence. *New England Journal of Medicine*. 2017 Jun 15;376(24):2367-75.
4. Fincke BG, Miller DR, Turpin R. A classification of diabetic foot infections using ICD-9- CM codes: application to a large computerized medical database. *BMC health services research*. 2010 Dec;10(1):1-9.
5. World Health Organization (WHO) (2016). Global Report on Diabetes. Available from:http://apps.who.int/iris/bitstream/handle/10665/204871/9789241565257_eng.pdf;jsessionid=918821FC88B9F4697792D707C49AE514?sequence=1.
6. Atlas D. International diabetes federation. *IDF Diabetes Atlas, 7th edn*. Brussels, Belgium: International Diabetes Federation. 2015;33.
7. Wagner Jr FW. The dysvascular foot: a system for diagnosis and treatment. *Foot & ankle*.1981 Sep; 2(2):64-122.
8. Viswanathan V, Jasmine JJ, Snehalatha C, Ramachandran A. Prevalence of pathogens in diabetic foot infection in South Indian type 2 diabetic patients. *The Journal of the Association of Physicians of India*. 2002 Aug 1;50:1013-6.
9. Taghipour A, Moshki M, Mirzaei N. Determination of effective factors on self-care behaviors in women with diabetes referring to Mashhad health centers. *Iranian Journal of Health Education and Health Promotion*. 2017 Dec 10;5(4):328-35.

10. Kaur J. A study to assess the knowledge and attitude related to diabetic foot and its prevention among diabetics attending medical outpatient department in selected hospitals of sri muksar sahib, punjab. *Asian Journal of Nursing Education and Research*. 2014;4(1):50.
11. Desalu OO, Salawu FK, Jimoh AK, Adekoya AO, Busari OA, Olokoba AB. Diabetic foot care: self-reported knowledge and practice among patients attending three tertiary hospital in Nigeria. *Ghana Med J* 2011; 45(2):60e5.
12. Seyyed rasooli A, Parvan K, Valizadeh L, Rahmani A, Zare M, Izadi T. Self-efficacy in foot care and effect of training: a single-blinded randomized controlled clinical trial. *Int J Community Based Midwifery* 2015;3(2):141e.
13. Moradi, A., Alavi, S.M., Salimi, M., Nouhjah, S. and Shahvali, E.A., 2019. The effect of short message service (SMS) on knowledge and preventive behaviors of diabetic foot ulcer in patients with diabetes type 2. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, 13(2), pp.1255-1260.
14. Hazavehei SM, Sharifirad G, Mohabi S. The effect of educational program based on health belief model on diabetic foot care. *International Journal of Diabetes in Developing Countries*. 2007 Jan 1;27(1).
15. Kasar KS, Asiret GD, Yilmaz CK, Canlar Ş. The effect of model-based telephone counseling on HbA1c and self-management for individuals with type 2 diabetes: A randomized controlled trial. *Primary Care Diabetes*. 2022 Feb 1;16(1):41-8
16. Adolfsson ET, Walker-Engström ML, Smide B, Wikblad K. Patient education in type 2 diabetes—a randomized controlled 1-year follow-up study. *Diabetes research and clinical practice*. 2007 Jun 1;76(3):341-50.
17. Abdo NM, Mohamed ME. Effectiveness of health education program for type 2 diabetes mellitus patients attending Zagazig University Diabetes Clinic, Egypt. *J Egypt Public Health Assoc*. 2010 Jan 1;85(3-4):113-30.
18. Nguyen TP, Edwards H, Do TN, Finlayson K. Effectiveness of a theory-based foot care education program (3STEPFUN) in improving foot self-care behaviours and foot risk factors for ulceration in people with type 2 diabetes. *Diabetes research and clinical practice*. 2019 Jun 1;152:29-
19. Tan MY, Magarey JM, Chee SS, Lee LF, Tan MH. A brief structured education programme enhances self-care practices and improves glycaemic control in Malaysians with poorly controlled diabetes. *Health education research*. 2011 Oct 1;26(5):896-907.
20. Hassan ZM. Mobile phone text messaging to improve knowledge and practice of diabetic foot care in a developing country: feasibility and outcomes. *International journal of nursing practice*. 2017 Jun;23:e12546.
21. Monami M, Zannoni S, Gaias M, Nreu B, Marchionni N, Mannucci E. Effects of a short educational program for the prevention of foot ulcers in high-risk patients: a randomized controlled trial. *Internet J Endocrinol* 2015;2015: 615680.
22. Ahmed MM, Degwy HME, Ali MI, Hegazy NH. The effect of educational intervention on knowledge, attitude and glycemic control in patients with type 2 diabetes mellitus. *Int J Community Med Public Health* 2015;2(3): 302e7.
23. Zareban I, Niknami S, Hidarnia A, Rakhshani F, Shamsi M, Karimy M. Effective intervention of self-care on glycaemia control in patients with type 2 diabetes. *Iran Red Crescent Med J* 2014;16(12). e8311.
24. Bin Abbas B, Al Fares A, Jabbari M, El Dali A, Al Orif F. Effect of mobile phone short text messages on glycemic control in type 2 diabetes. *Int J Endocrinol Metabol* 2015;13(1), e18791.
25. Fatehi F, Malekzade G, Akhavamirab A, Rashidi M, Afkhami-Ardekani M. The effect of short message service on knowledge of patients with diabetes in Yazd, Iran. *IJDO* 2010;2(1):27e31.
26. Sriram M, Doke P, Dasila P. Effectiveness of foot care education among people with Diabetes Mellitus in urban community, Mumbai. *Int J Pharm Biol Sci*. 2018;13(2):1-4.
27. Vatankhah N, Khamseh ME, Noudah YJ, Aghili R, Baradaran HR, Haeri NS. The effectiveness of foot care education on people with type 2 diabetes in Tehran, Iran. *Primary care diabetes*. 2009 May 1;3(2):73-7.
28. Otero LM, Zanetti ML, Ogrizio MD. Knowledge of diabetic patients about their disease before and after implementing a diabetes education program. *Revista Latino-Americana de Enfermagem*. 2008;16:231-7.
29. Soundarya, M., Asha, A. and Mohan, V., 2004. Role of a diabetes educator in the management of diabetes. *International Journal of Diabetes in Developing Countries*, 24, pp.65-8.