ScientificScholar®
Knowledge is power
Publisher of Scientific Journals

https://ijmsweb.com

Indian Journal of Medical Sciences

Article in Press

Original Article

The impact of focused education on diabetic foot care knowledge among adult type 2 diabetic patients: A hospital-based comparative study

Christiana Chika Agunanne[1], Chijioke Stanley Anyigor-ogah[1], Ikenna Alphonsus Ozioko[1], Nnaemeka Christopher Oguejiofor[1], Okechukwu Anyigor-ogah[2], Benjamin Chukwuemeka Agunanne[3], Chibueze Ogbodo Nweke[1], Idika Mba Idika[4]

[1]Department of Family Medicine, Alex-ekwueme Federal University Teaching Hospital, Abakaliki, [2]Department of Human Anatomy, Alex-ekwueme Federal University, Ikwo, [3]Department of Radiology, Alex-ekwueme Federal University Teaching Hospital, Abakaliki, [4]Department of Family Medicine, David Umahi Federal University Teaching Hospital, Ohaozara, Nigeria.

ABSTRACT

Objectives: This study assessed the effect of focused education on diabetic foot care knowledge (DFCK) among adult type 2 diabetic patients.

Materials and Methods: It is a randomized controlled study which involved 142 type 2 diabetic patients who met the inclusion criteria, whose DFCK were assessed using an interviewer-administered questionnaire. Collected data were grouped and analyzed using the Statistical Package for the Social Sciences software version 22. The effect of focused education and general education on the two arms of the study was examined using the mixed analysis of variance, whereas changes in the mean score of the outcome variables were compared using paired *t*-test.

Results: Participants who received focused education improved significantly when compared to the control group on foot-care knowledge ($t = 3.08$, $P = 0.003$, effect size = 5.16). The pre-intervention mean standard deviation body mass index (kg/m^2) showed a statistically significant difference between the experimental and control group ($P = 0.005$). Participants had statistically significant glucose control post-intervention ($P < 0.001$), with statistically significant excellent DFCK in the experimental group compared to the control ($P < 0.001$).

Conclusion: Primary care physicians are encouraged to take the center-stage and adopt this cost-effective, easy, and efficient practice of ensuring that patients with type 2 diabetes mellitus are adequately educated on foot care as key component of diabetic care and health promotion aimed to prevent complications which most likely reduces their quality of life.

Keywords: Foot care, Diabetes, Education, Self-efficacy, Knowledge

INTRODUCTION

Untreated diabetes mellitus can cause acute or long-term complications. Serious long-term complications of diabetes mellitus include cardiovascular disease, stroke, chronic kidney disease, damage to the eyes, and diabetic foot.[1] The predicted incidence of diabetes in Africa is 1% in rural areas and ranges from 5% to 7% in urban sub-Saharan Africa.[2] For developing countries, factors related to poverty, literacy and environmental barriers, delays in seeking treatment, and less priority given to foot-care by both patients and health providers had been adduced as major contributing factors that can increase the risk of foot complications.[3]

Studies have showed that diabetic foot disease accounted for increased cases of all diabetic admissions.[4,5] Another study concluded that education may encourage routine foot care but those who are dependent on either formal or informal support to perform foot care do so less frequently.[6,7] Higher level of education and age <65 years old is significantly associated with higher score for previous foot care education.[8] Another study opined that poor knowledge of diabetes is related to age, level of education, satisfaction with the education received, employment status, and household wealth.[9] These findings are similar to studies by Desalu *et al.* and Alatawi *et al.* both in methodology and results.[10,11] Bosun-Arije *et al.* and Kassahun *et al.* found poor foot self-care knowledge and critical gaps in foot care practice.[12,13] A systematic review by Bonner and colleagues revealed that improving type 2 diabetes foot-related complications would require foot care

***Corresponding author:** Chijioke Stanley Anyigor-ogah, Department of Family Medicine, Alex-ekwueme Federal University Teaching Hospital, Abakaliki, Nigeria. ogahstanly90@yahoo.com

Received: 12 October 2024 **Accepted:** 24 November 2024 **Epub ahead of print:** 26 December 2024 **Published:** XXXXXXXX **DOI:** 10.25259/IJMS_236_2024

intervention that includes foot care knowledge and foot care practices.[14]

MATERIALS AND METHODS

Study design

This study was a randomized double blind controlled study.

Sample size

The sample size (n) was calculated thus[15]

$$n = \frac{\left(Z_{\alpha} + Z_{\beta}\right)^2 x\left[P_1\left(1-P_1\right) + P_2\left(1-P_2\right)\right]^2}{\left[P_1 - P_2\right]^2}$$

Where; n = sample size in each group, Zα = 1.96, standard normal deviate at 95% confidence level, Zβ = 0.84, standard normal deviate at desired power of 80%, P_1 taken as 78%, P_2 = Control group response, inserting the required information in the formula; n = 57 subjects. Adjusting for attrition, n was 71 per group.

Sampling method

An equal number of computer-generated codes FE and HG were used to group the intervention and control groups, respectively. Participants were randomized into two groups daily by the researcher. Inclusion into this study was adults aged between 18 and 60 years who had been diagnosed to have type 2 diabetes for at least 1 year; all adults with diabetes who met the above criteria and voluntarily agreed to participate in the study; access to a mobile phone by the participant (this was necessary due to the weekly reminders sent to the participants in the experimental group). Exclusion from this study was type 2 adult diabetics with severe medical conditions.

Study instruments

These included an interviewer-administered and semi-structured questionnaire: Revised version of the Summary of Diabetes Self-Care Activities measure, and Diabetic Foot Knowledge Subscale for foot care knowledge.[16] Research assistants were trained to assist with the recruitment and data collection and were made to know the aim and objectives of the research work.

Research protocol

Informed written consent was obtained from the participants. Phase 1 activities were done at first contact**.** After the initial evaluation, foot care education was provided by the researcher to each patient in the experimental group. Phase 2 activity was purely post intervention with questionnaire administered and measurements taken. None of the participants had the power to choose the group they belonged to. Outcome assessors and the data analyst were kept blinded to the allocation. Subjects' anthropometry and blood pressure were measured using standard procedure and instruments and the values calculated and recorded. After an overnight fast, the point of care instrument was used to assess the fasting plasma glucose of every participant. Care was taken to ensure the insertion of the correct code key and that all strips had the same batch number.

Table 1: Socio-demographic characteristics of the study participants.

Variables	Experimental (n=71)	Control (n=71)	Test stat	P-value
Mean age in years (SD)	54.77 (13.09)	49.40 (11.55)	t=2.58	0.01*
Gender (%)				
Male	29 (40.8)	38 (53.5)	χ^2=3.56	0.17
Female	42 (59.2)	33 (46.5)		
Marital status (%)				
Single	4 (5.6)	10 (14.1)	χ^2=2.28	0.32
Married	49 (69.0)	46 (64.8)		
Separated/divorced/widowed	18 (25.4)	15 (21.1)		
Educational status (%)				
No formal	8 (11.3)	5 (7.0)	χ^2=14.14	0.003*
Primary	12 (16.9)	19 (26.8)		
Secondary	16 (22.5)	31 (43.7)		
Tertiary	35 (49.3)	16 (22.5)		
Social class (%)				
Upper	0 (0.0)	0 (0.0)	χ^2=4.37	0.11
Middle	32 (45.1)	22 (31.0)		
Lower	39 (54.9)	49 (69.0)		

NB: SD: Standard deviation, **P*-value significant, *t*: T-test, χ^2: Chi square test

Table 2: Clinical characteristics of the study participants at pre-intervention/post-intervention.

Clinical variables	Pre-intervention (*n*=142)				Post-intervention (*n*=142)			
	Experiment	Control	*t*-stat	*P*-value	Experiment	Control	*t*-stat	*P*-value
FBG (mg/dL)								
Mean (SD)	166.96 (94.16)	163.99 (85.33)	U=2424	0.80	111.34 (30.04)	142.09 (43.73)	U=2424	0.80
95% CI	147.51–192.41	143.79–184.18			104.23–118.45	131.58–152.59		
Glycemic control (%)								
Good	19 (26.8)	17 (23.9)	χ^2=0.06	0.81	55 (77.50)	28 (40.0)	χ2=20.4	<0.001*
Poor	52 (73.2)	54 (76.1)			16 (22.5)	42 (60.0)		
BMI (kg/m^2)								
Mean (SD)	26.65 (5.06)	24.29 (4.95)	U=1834.50	0.005	25.79 (4.57)	24.88 (4.81)	U=2206	0.20
95% CI	25.44–27.85	23.12–25.47			24.71–26.87	23.73–26.04		
MBI category (%)								
<18 kg/m^2	3 (4.2)	8 (11.3)	χ^2=5.74	0.05	6 (8.6)	7 (10)	χ2=0.79	0.85
18–24.9 kg/m^2	24 (33.8)	34 (47.9)			25 (35.7)	29 (41.4)		
≥25 kg/m^2	44 (62.0)	29 (40.8)			39 (55.7)	34 (48.2)		
SBP (mmHg)								
Mean (SD)	136.38 (24.05)	134.52 (23.86)	U=2394	0.61	133.38 (24.05)	135.52 (23.86)	U=2384	0.51
95% CI	130.69–142.07	128.87–140.17			131.69–142.07	129.87–140.17		
DBP (mmHg)								
Mean (SD)	79.27 (10.13)	75.87 (12.91)	U=2059	0.05	69.27 (10.13)	70.87 (12.91)	U=2049	0.07
95% CI	76.86–81.69	72.82–78.93			76.86–81.69	72.82–78.93		
RR (c/m)								
Mean (SD)	17.70 (2.32)	19.21 (13.11)	U=2451	0.89	17.48 (1.59)	17.67 (1.64)	U=2358	0.59
95% CI	17.15–18.25	16.11–22.31			17.10–17.86	17.27–18.06		
Duration of DM (years)								
Mean (SD)	5.90 (5.83)	4.77 (3.90)	U=2430	0.71	5.93 (5.83)	4.80 (3.86)	U=2440	0.74
95% CI	4.52–7.28	3.85–5.70			4.55–7.31	3.89–5.72		
Mean PR/min	85.30 (11.61)	81.63 (11.0%)	*t*=1.93	0.05	87.00 (8.03)	83.41 (8.16)	*t*=2.73	0.007*

NB: DBP: Diastolic blood pressure, SBP: Systolic blood pressure, RR: Respiratory rate, PR: Pulse rate, CI: Confidence interval, SD: Standard deviation, C/M: Cycles per minutes, FBG: Fasting blood glucose, FBG ≤110 g/dL: Good glycemic control, FBG >110 g/dL: Poor glycemic control, U: Mann–Whitney U-test, *: *P*-value significant, *t*: *t*-test, χ^2: Chi-square test, BMI: Body mass index

Data analysis

The data were analyzed using the Statistical Package for the Social Sciences software version 22. Quantitative variables were presented as mean ± standard deviations (SDs), while the qualitative or categorical variables were presented in percentages and proportions. *t*-test statistics were used to assess for the difference between two likely normally distributed quantitative variables while Chi-square was used for categorical variables. Mann–Whitney U-test was used to find the difference of likely non-parametric quantitative variables between two groups. The significance level was set at <0.05, while the confidence level was set at 98%.

RESULTS

Socio-demographic characteristics of the study participants

There was an overall mean age of 52.09 years. In general, the socio-demographic characteristics of the experimental group and the control group were similar but for the mean age (P = 0.01) and educational status (P = 0.003), as shown in Table 1.

Table 3: Comparison of the changes in the outcome variables at pre- and post-focused educational intervention among the experimental and control groups.

Variables	Mean (SD)	*t*-test	*P*-value
Experimental group			
Post-intervention DFKS	3.83 (0.90)	−5.16	<0.001
Pre-intervention DFKS	3.35 (1.32)		
Control group			
Post-intervention DFKS	3.61 (1.11)	−4.46	<0.001
Pre-intervention DFKS	3.07 (1.28) ss		

NB: DFKS: Diabetic foot knowledge scale, SD: Standard deviation

Pre-intervention/post-intervention clinical characteristics of the study participants

The pre-intervention mean (SD) body mass index (BMI) (kg/m^2) for the experimental and control groups had a

Table 4: Comparison of the effect of the intervention on the experimental and control groups on DFCK across intervals of follow-up.

Variable	Group	Mean Difference	*t*-test	*P*-value	Effect size
DFCK T_0	Experimental Control	0.55	2.54	0.01	0.48
DFCK T_1	Experimental Control	0.45	3.08	0.003	5.16

T_0: Pre-intervention, T_1: Post-intervention, DFCK: Diabetic foot care knowledge

statistically significant difference between them ($P = 0.005$). There existed a statistically significant glycemic control of the participants post-intervention ($P < 0.001$) [Table 2].

Comparison of the changes in the outcome variables at pre- and post-focused educational intervention among the experimental and control groups

There were significant changes in the mean diabetic foot care knowledge (DFCK) in the baseline and post-intervention values of the experimental group ($P < 0.001$) and in the control group ($P < 0.001$). It is as illustrated in Table 3.

Comparison of the effect of the intervention on the experimental and control groups on DFCK across intervals of follow-up

The mean difference between the experimental and the control groups was significant at baseline/pre-intervention ($P = 0.01$) and at post-intervention ($P = 0.003$) [Table 4].

DISCUSSION

Only age and education level had observable statistical significant difference. The statistical significance in age is similar to a work done by Shabani Hamedan *et al.* who, in their study, found a statistical significance in the age of participants.[17] This might have been due to semi-urban and rural setting nature of the study area, respectively, with a great number of the middle-aged and elderly population. Studies in Ado-Ekiti and Ilorin (both in Nigeria) reported lower mean age while a Malaysian study reported higher mean age.[10,18,19] Racial and cultural differences could have played roles in the above variations. The high level of illiteracy and low socioeconomic status found among many rural and suburban dwellers have contributed to the early age of type 2 diabetes there.[10] Beyond the age of 55 years, the urban prevalence is estimated to be more than twice the rural prevalence.[20] The intervention and the control groups had no significant difference observed between them in marital status ($P = 0.32$). This similarity may be due to early and intracultural marriage prevalent among the study population. This finding is different from a study by Karimy *et al.* who had more married participants.[21]

There was a statistical significant difference between the experimental and control group in educational status ($P = 0.003$) but when this difference was controlled for (using analysis of variance), there was no significance noted. The significance in educational status could be that those who presented to the hospital are majorly the literate ones as those with little education could be in denial of their illness and do not present for expert care. They could also be receiving care from sources other than orthodox care.

There was statistically significant difference in the glycemic control findings among the participants of the experimental and the control group at baseline and post-intervention ($P < 0.001$). This finding may have been due to improvements in the intervention group participants' attitude to self-care measures and daily blood glucose monitoring. Highly statistically significant difference existed in the BMI of the participants pre-intervention ($P = 0.005$). However, after the intervention, no statistical significance difference was found. This result may have been due to improved diet and exercise as practiced by the intervention group following the intervention. This result is similar to a study by Steinsbekk *et al.*,[22] but differs from another study by Gray *et al.*, who found that moderately elevated BMI is associated with increased risk of foot complications.[23] The duration of diabetes recorded among the participants of the experimental and the control group at baseline and at post-intervention had no significant difference. This finding differs from that of Ko *et al.*, who demonstrated that the longer the duration of diabetes, the more inadequate glycemic control and vice versa.[24]

DFCK improved significantly among participants who received focused education when compared with those who received general education post-intervention ($P = 0.003$). These findings are consistent with previous reports that have demonstrated significant improvement in DFCK following education.[25,26] A study by Al-Wahbi documented that diabetic foot care education program helped increase patients' knowledge of diabetes mellitus and reduced the rate of lower limb amputations, unlike before the intervention.[27]

CONCLUSION

The implementation of an education program on diabetic foot care in our outpatient clinics will significantly improve the knowledge and feet self-care in diabetic patients. This educational intervention showed the importance of training in patient's empowerment and their self-care.

Acknowledgment

We thank the management and its Research and Ethics Committee for the prompt approval, as well as the departmental board and members of Family Medicine Department for the direction provided towards the successful conduct of this research. Special thanks to the respondents who gave their consent and participated very actively in this research.

Availability of data and materials

The sets of data generated and analyzed in this study are available from the corresponding author on reasonable request through the E-mail address of ogahstanly90@yahoo.com or ogahstanly90@gmail.com.

Ethical approval

Ethical approval was obtained from the Hospital Ethical Review and Research Committee (FETHA/REC/VOL.1/2017/625), dated 19th December 2017. This research work complied with the Helsinki Declaration 2013 on human research.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

REFERENCES

1. Chen L, Magliano DJ, Zimmet PZ. The worldwide epidemiology of type 2 diabetes mellitus-present and future perspectives. Nat Rev Endocrinol 2011;8:228-36.
2. Ogbera AO, Ekpebegh C. Diabetes mellitus in Nigeria: The past, present and future. World J Diabetes 2014;5:905-11.
3. American Diabetes Association. Diagnosis and classification of diabetes mellitus. Diabetes Care 2014;37(Suppl 1):81-90.
4. Otu AA, Umoh VA, Essien OE, Enang OE, Okpa HO, Mbu PN. Profile, bacteriology, and risk factors for foot ulcers among diabetics in a tertiary hospital in Calabar, Nigeria. Ulcers 2013;2013:820468.
5. Al-Hariri MT, Al-Enazi AS, Alshammari DM, Bahamdan AS, Al-Khtani SM, Al-Abdulwahab AA. Descriptive study on the knowledge, attitudes and practices regarding the diabetic foot. J Taibah Univ Med Sci 2017;12:492-6.
6. Chiwanga FS, Njelekela MA. Diabetic foot: Prevalence, knowledge, and foot self-care practices among diabetic patients in Dar es Salaam, Tanzania - a cross-sectional study. J Foot Ankle Res 2015;8:20.
7. Ozawa K, Tomisawa T, Sakuraba S, Urushizaka M, Kitajima M, Itaki C, *et al*. Factors related to changes in foot status and foot care in patients with diabetes mellitus participating in an exercise health education program. J Diabetes Mellit 2014;4:67-71.
8. Goie TT, Naidoo M. Awareness of diabetic foot disease amongst patients with type 2 diabetes mellitus attending the chronic outpatients department at a regional hospital in Durban, South Africa. African J Prim Health Care Fam Med 2016;8:e1-8.
9. Asper US, Ogundunmade G, Opara MC, Akinrolie O, Pyiki EB, Umar A. Determinants of diabetes knowledge in a cohort of Nigerian diabetics. J Diabetes Metab Disord 2014;13:39.
10. 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;45:60-5.
11. Alatawi AA, Alrashedi MH, Alqarni AM. Assessment of self-awareness and perception of diabetic foot disease among people with type 2 diabetes mellitus in Tabuk. Egypt J Hosp Med 2018;70:1025-9.
12. Bosun-Arije FS, Ling J, Graham Y, Hayes C. A systematic review of factors influencing Type 2 diabetes mellitus management in Nigerian public hospitals. Int J Africa Nurs Sci 2019;11:100151.
13. Kassahun T, Gesesew H, Mwanri L, Eshetie T. Diabetes related knowledge, self-care behaviours and adherence to medications among diabetic patients in Southwest Ethiopia: A cross-sectional survey. BMC Endocr Disord 2016;16:28.
14. Bonner T, Foster M, Spears-Lanoix E. Type 2 diabetes-related foot care knowledge and foot self-care practice interventions in the United States: A systematic review of the literature. Diabet Foot Ankle 2016;7:29758.
15. Onwasigwe C. Principles and methods of epidemiology. 2nd ed. Enugu: Enugu Demark Publishers; 2010. p. 147-8.
16. Dorresteijn JA, Kriegsman DM, Assendelft WJ, Valk GD. Patient education for preventing diabetic foot ulceration. Cochrane Database Syst Rev 2014;2014:CD001488.
17. Shabani Hamedan M, Shabani Hamedan M, Sadegh Torki Z. Relationship between foot-care self-efficacy beliefs and self care behaviors in diabetic patients in Iran (2011). J Diabetes Metab 2012;3:1-5.
18. Sharoni SK, Rahman HA, Minhat HS, Shariff-Ghazali S, Ong MH. The effects of self-efficacy enhancing program on foot self-care behaviour of older adults with diabetes: A randomised controlled trial in elderly care facility, Peninsular Malaysia. PLoS One 2018;13:e0192417.
19. Sharoni SK, Abdul Rahman H, Minhat HS, Shariff Ghazali S,

Azman Ong MH. A self-efficacy education programme on foot self-care behaviour among older patients with diabetes in a public long-term care institution, Malaysia: A Quasi-experimental Pilot Study. BMJ Open 2017;7:e014393.
20. Cheema A, Adeloye D, Sidhu S, Sridhar D, Chan KY. Urbanization and prevalence of type 2 diabetes in Southern Asia: A systematic analysis. J Glob Health 2014;4:010404.
21. Karimy M, Koohestani HR, Araban M. The association between attitude, self-efficacy, and social support and adherence to diabetes self-care behavior. Diabetol Metab Syndr 2018;10:86.
22. Steinsbekk A, Rygg L, Lisulo M, Rise MB, Fretheim A. Group based diabetes self-management education compared to routine treatment for people with type 2 diabetes mellitus. A systematic review with meta-analysis. BMC Health Serv Res 2012;12:213.
23. Gray N, Picone G, Sloan F, Yashkin A. Relation between BMI and diabetes mellitus and its complications among US older adults. South Med J 2015;108:29-36.
24. Ko SH, Park SA, Cho JH, Ko SH, Shin KM, Lee SH, *et al*. Influence of the duration of diabetes on the outcome of a diabetes self-management education program. Diabetes Metab J 2012;36:222-9.
25. Baba M, Duff J, Foley L, Davis WA, Davis TM. A comparison of two methods of foot health education: The Fremantle diabetes study phase II. Prim Care Diabetes 2014;9:155-62.
26. Cheng J, Zhang W, Zhang X, Han F, Li X, He X, *et al*. Effect of angiotensin-converting enzyme inhibitors and angiotensin II receptor blockers on all-cause mortality, cardiovascular deaths, and cardiovascular events in patients with diabetes mellitus: A meta-analysis. JAMA Intern Med 2014;174:773-85.
27. Al-Wahbi AM. Impact of a diabetic foot care education program on lower limb amputation rate. Vasc Health Risk Manag 2010;6:923-34.

How to cite this article: Agunanne CC, Anyigor-ogah CS, Ozioko IA, Oguejiofor NC, Anyigor-ogah O, Agunanne BC, *et al*. The impact of focused education on diabetic foot care knowledge among adult type 2 diabetic patients: A hospital-based comparative study. Indian J Med Sci. doi: 10.25259/IJMS_236_2024