

Effect of Educational Nursing Protocol on Foot Self-Care Practices among Diabetic Elderly Patients

Marwa Kamal Ahmed ¹, Gehan Sayyed Ali ², Aml Ali Mohamed³, Marwa Ibrahim Mohamed⁴
Rokaia Fathi Mohamed⁵

1. Assistant Lecturer in Medical Surgical Nursing Department (Gerontological Nursing), Faculty of Nursing, Minia University, Egypt.
 2. Prof. Department of Medical Surgical Nursing, Faculty of Nursing, Minia University, Lotus University, 61768, Minia, Egypt.
 3. Assistant Prof. in Medical Surgical Nursing Department (Gerontological Nursing), Faculty of Nursing, Minia University, Lotus University, 61768, Minia, Egypt.
 4. Lecturer of Internal Medicine and Endocrinology, Faculty of Medicine, Minia University, Egypt.
 5. Assistant Prof. in Medical Surgical Nursing Department (Gerontological Nursing), Faculty of Nursing, Minia University, Egypt.
- *Email of the corresponding author: Marwa_Kamal2025@yahoo.com

Abstract

Background: Foot ulceration is a major complication of diabetes among older adults. Regular foot self-care is vital for reducing the risk of diabetes-related foot problems. **Aim of the study:** To evaluate the effect of an educational nursing protocol on foot self-care practices among diabetic elderly patients. **Research design:** A Quasi-experimental research design (study / control) was utilized to fulfill the aim of this study. **Subjects:** A purposive sample of (120) diabetic elderly patients, divided into two equal groups (study and control), (60) patients for each group. **Setting:** This study was carried out in the medical outpatient clinic at Minia University Hospital, Egypt. **Tools:** Four tools were utilized. **Tool I:** Patient assessment sheet. **Tool II:** Patient's knowledge questionnaire about foot self-care **Tool III:** Nottingham assessment of functional foot care scale (NAFFC) **Tool IV:** Peripheral circulation assessment tool. **Results:** The means of age were (66.2 ± 3.74 & 65.9 ± 4.59) for the study and control groups respectively, and more than half of the both groups were females. There was a significant improvement in mean score of foot self-care practices to be (43.4 ± 3.71) at posttest compared to (22.3 ± 3.87) before the intervention. **Added to the study** group exhibited sufficient (good) peripheral perfusion with percentages of (65%) and (61.7%) for right and left leg respectively after 8 weeks of applying the Buerger Allen Exercise as compared to (43.3% & 41.7%) before, with a highly statistical significance difference ($P \leq 0.01$) was detected between the two groups. **Conclusion:** The implementation an educational nursing protocol had positive effects on increasing foot self-care practices and consequently improving lower extremities perfusion at follow up phases. **Recommendations:** Continuous teaching sessions about foot self-care practices is recommended for diabetic elderly in all health care settings to prevent occurrence of foot problems.

Key Words: Diabetic Elderly patients, Educational Nursing Protocol, Foot Self-care.

Introduction

Diabetes mellitus (DM) is a group of chronic metabolic disorders characterized by elevated blood glucose level that is associated with significant morbidity, mortality and increasing health care cost. Recently the majority increased number of individuals over 65 years of age with diabetes is projected to reach 195.2 million in 2030 and 276.2 million by 2045 worldwide (Asiimwe et al., 2020). The global prevalence of diabetic foot ulcers (DFUs)

is estimated to be (6.3%). According to an Egyptian study; the DFUs represented (6.1%) to (29.3%) among diabetic patients and most of them were elderly people (Hassan et al., 2021).

Diabetic related lower extremity complications (DRLEC) are common and imposing an enormous burden on the health care systems due to the rapid growth of diabetes worldwide. DRLEC include peripheral neuropathy, peripheral arterial

disease, ulceration, infection, gangrene, and amputations (**Riandini et al., 2021**).

Diabetic foot is the most common of these complications which defined as an ulceration of the foot (distally from the ankle and including the ankle) associated with neuropathy and different grades of ischemia and infection (**Astasio-Picado et al., 2022**). Also, lower-extremity peripheral artery disease is another most common complication among elderly diabetic patients characterized by a gradual decrease in blood flow to one or both limbs (**Stancu et al., 2022**). It responsible for up to (50%) of diabetic foot ulcers cases with a prevalence rate of foot amputation reached to (48%). Diabetic elderly patients have a two to four times of increased the rate of peripheral arterial disease than other age groups (**Behroozian & Beckman, 2020**).

The risk of foot ulceration, peripheral arterial disease and amputation increases with age and the duration of diabetes. So, the prevention of diabetic foot problems through an effective foot-self management is crucial, associated with positive impact on a patient's quality of life and economic burden on the healthcare (**Francisco et al., 2022**).

Nurses have an effective role in reducing the risk of these problems by providing the needed education regarding foot self-care practices which include a daily inspection of feet and monitor feet with the use of mirrors for color change, swelling, break in the skin, pain or numbness associated with wearing shoes, emphasize foot hygiene such as daily washing and carefully drying the feet in between toes, providing nail care, cut their nails straight, as well as wearing well-fitting shoes and hosiery, and avoiding walking barefoot (**Vincent-Edinboro & Onuoha, 2022**).

Foot self-care practices involved education about vital exercise named as Buerger-Allen (PBA) to enhance peripheral perfusion and reduce the incidence of peripheral artery disease. It is one of the easiest and cost effective exercise performed to promote lower extremity perfusion by using postural changes and stimulated peripheral circulation through modulating gravity and applying muscle contraction for improving the lower extremity perfusion (**El Rasek & Hassan, 2020 & El Sayed et al., 2021**).

Foot assessment and foot care combined with adequate monitoring for peripheral perfusion is a crucial aspect of nursing patient care to evaluate blood flow in the peripheral microcirculation of the skin, nail beds, and other tissues. It is important for nursing staff to keep peripheral perfusion assessment as a part of routine care for diabetic

elderly patients to discover risky cases for peripheral artery disease (PAD) at early stages. The assessment involves pulse, capillary refill time (CRT), sensation, skin color and temperature which can indicate potential circulatory concerns (**Jenabi et al., 2025**).

Appropriate foot care practices, assessment of peripheral circulation, and enhancement of peripheral perfusion of lower extremities are critical crucial nursing roles in caring for diabetic elders to decrease the incidence of foot problems. Numerous recent studies indicated the educational sessions regarding foot care and adherence to Buerger-Allen exercises among diabetic elders was very beneficial to reduce the risk of diabetic foot (**Afida et al., 2022**).

Significance of the study:

Diabetes mellitus (DM) especially type II is the most common chronic diseases affecting older people and became an international health concern. Egypt is listed as one of the top ten countries with diabetic people. According to the central agency for public mobilization and statistics, the prevalence of DM among older adults in Egypt is (24.0%) in 2021(**Ghazi, 2022**), and the prevalence of type 2 diabetes mellitus is around (32.4%) among elderly population aged above 65 years (**Hegazy et al., 2022**).

In Egypt, diabetic foot problems are a prominent problem with high morbidity and mortality rates and associated with a negative impact on elderly patient's quality of life. According to an Egyptian study; the diabetic foot ulcerations (DFUs) reached to (29.3%) among diabetic patients due to lack of foot self-care management and most of them were elderly people (**Hassan et al., 2021**).

From the researcher clinical experience in medical ward and clinics, it was found that there is a little awareness about foot self-care practices among diabetic elderly patients and this can increase the risk for foot complications, deterioration for elderly health status and increase in health care costs. So this study was conducted.

Aim of the Study:

The aim of the study is to evaluate the effect of educational nursing protocol on foot self-care practices among diabetic elderly patients.

Hypothesis:

H1: The mean average score of patients' knowledge and practice about foot self-care will be increased after implementing the educational nursing

protocol among the study group compared to the control group.

H2: The mean average score of lower extremities perfusion will be increased after application of Burger Allen Exercise among the study group compared to the control group.

Subjects and Methods:

Research Design:

A Quasi-experimental research design (study/control) was utilized in the current study.

Setting of the study:

The study was carried out in the medical outpatient clinic and medical department at Minia University Hospital, Minia governorate, Egypt.

Study Subjects:

A purposive sample of (120) elderly patients selected by non-probability sampling technique were estimated centered on (Isaac and Michael 1995) formulation which is calculated as ($N=n \times 30/100$) in which:

N = Sample size

n = Overall number of 400 diabetic elderly patients admitted to Minia University Hospital during the last year (2021-2022).

$N=400 \times 30/100=120$ patient.

Then the researcher divided them into two equal groups study and control, (60) patients for each group.

-The sample was selected according to the following criteria:

Inclusion Criteria:

- 1) Patients 60 years old and more with type II diabetes mellitus.
- 2) Patients without peripheral vascular disease.

Exclusion Criteria:

- 1) Patients who refused to participate in the current study.
- 2) Unable to communicate.
- 3) Previous healed diabetic foot ulcer or present foot ulcer.
- 4) Cases exposed to previous educational program about foot self-care practices and Buerger Allen exercise.

Study Duration:

The total data collection was collected over a period of ten months starting from December 2023 to end of September 2024.

Study Tools:

Four tools were utilized to collect the data pertinent to the current study, these tools were tested by the researcher after pilot study and the content of the tools was established after extensive literature review and were revised by members of a jury who are experts in the field of study.

Tool (I): Patient Assessment Sheet. It is prepared by the researcher after reviewing of related literature, included **the two following parts:**

- **Part 1:** Covered the demographic data of the patient such as (patient's age, marital status, gender, education, residence, and occupation).
- **Part 2:** Covered medical data such as (the date of admission, duration of diabetes mellitus, family history and medication used).

Tool (II): Patients' Knowledge Questionnaire about diabetes and Foot Care Practices

This tool adopted from (**Mohammad and Khresheh, 2018**). It consists of main (15) items, each item have four multiple correct answers covered (definition of diabetes, manifestations, complications, and its management, meaning of foot ulcer, causes of foot ulceration and its signs and complications, how to perform foot inspection, proper foot hygiene, nail care, and proper foot wear included shoes and socks, also, methods of improving peripheral circulation).

Scoring system:

Each known answer was given a score of (one) and the wrong or unknown item was given a score of (zero), with a total possible score of (0 – 58). Those who was obtained less than (60%) are considering have unsatisfactory level of knowledge, while those who was obtained more than (60%) will be considered having satisfactory level of knowledge.

Tool (III): Nottingham Assessment of Functional Foot Care Scale (NAFFC)

This scale developed by (**Senussi et al., 2011**) to assess the level of foot self-care practices among diabetic patients. This scale consisted of (22) questions each question was recorded on a categorical scale ranging from (0–3) according to the frequency of existence of the practice. A total

practice score of $\geq 70\%$ of maximum score indicates good foot self-care practice while a score $50\% - 70\%$ indicates fair foot self-care practice and a score $< 50\%$ indicates poor foot self-care practice.

Tool (II): Peripheral Circulation Assessment Tool:

It was adopted from (Priya, 2016) concerned with assessment of lower extremities perfusion for diabetic patients. It contains six parameters are (peripheral pulses, capillary refill time, edema, temperature, pain, and skin color) each parameter has four responses ranged from normal perfusion (0), mild circulatory insufficiency (1), moderate (2), and severe circulatory insufficiency (3).

Scoring system for 6 peripheral circulation parameters:

First parameter is dorsalis pedis pulse with four responses are (normal, weak, non-palpable, or absent pulse). 2nd parameter one is Capillary refill time assessed via utilizing capillary refill test with categories of (1-2 sec., 3 sec., 4 sec. & >4 sec.). The 3rd parameter is presence of edema was categorized as (No edema, (+1) < 2 mm pitting that disappeared rapidly, (+2) 2 to < 4 mm pitting that disappeared in 10- 15 sec. & (+3) 4 to < 6 mm pitting that disappeared in 10-15 sec.). The 4th parameter is skin temperature that examined by using dorsum of hand with responses of (warm, mild, moderate & cold). The 5th parameter is pain which evaluated by using numerical scale (Jensen et al., 2001) and interpreted in to four responses (Zero mean No pain, from 1-3 Mild pain, from 4-6 Moderate pain & from 7-10 Severe pain), and the last parameter was observation of skin color with the four responses of (pink, Pale, Black, Reddish).

Total Score Interpretation of Peripheral Circulation Assessment scale

grade	Score	Interpretation
1	0-4	Good blood perfusion (sufficient blood supply)
2	5-9	Slightly Poor blood Perfusion (slightly insufficient)
3	10-14	Poor blood perfusion (insufficient)
4	15-18	Very poor blood perfusion (very insufficient)

Tools Validity:

- To establish validity, the tools was tested by a panel of three experts in the field of medical surgical nursing staff and geriatric nursing staff (Minia University) and the necessary modifications was done.

Tools Reliability:

- Reliability of tools was tested by Cronbach's Alpha test to measure the consistency of the study tools in which the foot care knowledge test was (0.84). The foot care practice scale test was reliable at (0.87). Also, peripheral circulation perfusion of lower extremity test was reliable at (0.897).

Pilot study:

A pilot study was done to test the feasibility of the study and the applicability of the tools. It was carried on 12 patients (10%) of total sample, who was included in the study as no major modifications applied.

Ethical Consideration:

- The study was applied after the official permission was obtained from ethical committee in the faculty of nursing and ethical committee in El-Minia university hospital director. Oral permission for voluntary participation was obtained by the researcher from each patient and their relatives.
- Confidentiality of data, privacy and researcher informed the patient that he/she has the right to right to refuse to participate in the study at any time. Confidentiality and anonymity of each subject were ensured through coding of all data and protecting the obtained data. The researcher explained to the patient and relatives the aim of the study, potential benefits in case he/she follows the steps of care.

Study procedure

Preparatory phase:

The study was conducted via four three: Assessment, implementation, evaluation and follow-up phases as a following:

- An official approval was obtained from the responsible authorities for conducting this study. Once an official permission was granted to advance with the proposed study, the researcher initiates collection of the study data by visiting the outpatient clinics, which work six day per week from 9 a.m. to 1 p.m. at Minia university hospital, the researcher visited out-patient clinics three days per week at morning shifts.
- Informed consent was obtained for each participant to fulfilling the study criteria after informing them about the purpose of the current study and they had free to withdraw from the study at any time.

- Nursing educational booklet was prepared after reviewing recent related literature in simple Arabic language and with colored pictures given to the patients of the study group, which includes two main parts:
- First part includes information about (definition of diabetes, types, causes or risk factors, clinical manifestations, management and complications).
- Second part includes steps of foot self-care practices and burger Allen exercise.
- The study was conducted via four phases: Assessment, implementation, evaluation and follow-up phases as a following:

1. Assessment phase:

- During this phase the researcher was interviewed with the patients and relatives during their attendance to the medical outpatient's clinic or departement in the morning shift to introduce her-self, explained the nature and purpose of the study and then the researcher obtained oral and written consent from those who accepted to participate in this study.
- The researcher firstly started the collection of data from the control group which included (60) patients who received routine hospital nursing care by using the fourth study tools. Demographic data and medical data gathered by using tool (I). patients' knowledge and practice as well as peripheral perfusion assessment evaluated by utilizing the second, third and fourth tools respectively. This took around (30-45) minutes for each patient to complete the assessment questionnaire sheet.
- After finishing data collection from the control group, the researcher started collection of data from the study group by face to face interview at the previous mentioned settings through using the same 4th tools as base line data which spent about (30-45) minutes for each patient to complete them according their attention and tolerance.

Implementation phase:

- After finishing data collection from the study group, the researchers began to deliver the educational nursing sessions.
- Three planned educational sessions divided into
 - **1st session** designed to cover for the theoretical part through using face to face lecture, posters, videos, discussion, and handouts with coloured images as

teaching methods covered the following information (diabetes definition, manifestations, complications, peripheral artery disease definition and manifestations, Burger Allen exercise description and its benefits). It took about 20-40 minutes.

- **2nd second** planned for the practical part concerned foot self-care practices included washing their feet daily with adequate dryness, examining the bottoms of their feet and between toes, well drying feet and between toes, trimming toenails straight across, applying moisturizing lotion to their feet, wearing cotton socks most time, suitable shoes, checking the inside of their shoes before putting them on...etc). Its duration was 25-35 minutes according patient's responses.
- **3rd session** designed to cover training about Burger Allen exercise that involves a series of postural changes to improve blood circulation in the lower extremities the session took about 15-20 minutes. The exercise consists of three steps: elevation, dependency, and rest. The patient elevates their legs, then lowers them to encourage blood flow, and finally rests with legs horizontal. The intervention group endorsed to perform the exercise (5-6) times per day, each time (12-15 minutes), and period of exercise constant for eight weeks.
- The practical part performed utilizing PowerPoint, discussion, demonstration and re-demonstration as teaching methods, as well as, an educational brochure in simple Arabic language with colored pictures given to each patient of the study group, which included steps of Buerger Allen exercise to ensure that the patients and their relative well understood the steps and right technique to perform it independently and perfectly at home.

III-Evaluation phase

The outcome of designed nursing educational protocol on improving patients 'knowledge, practice and peripheral circulation was re-assessed by utilizing the second, third and fourth tools respectively at follow up phases (after one month and after two months) for both groups.

- The researcher followed the patients of the study group in outpatient clinics and via telephone

weekly after being discharged to ensure the compliance to foot self-care and Buerger Allen exercise at home. The researcher offered medications that prescribed by the physician in the

department and outpatient clinics for patients to enhance a continuous follow up. After finishing the study the researcher gave the nursing educational booklet to the patients of the control group.

Results

Table (1): Percentage Distribution of Study and Control Group Regarding their Demographic Data (n=120)

Demographic Data	Study Group (n=60)		Control Group (n=60)		Sig test (P value)
	No	%	No	%	
Age					
- 60 < 65 years	15	21.7	21	35.0	F = 5.11 (0.056)
- 65 < 70 years	38	63.3	30	50.0	
- ≥ 70	7	11.6	9	15.0	
Mean of age	66.2 ± 3.74		65.9 ± 4.59		
Gender					
- Male	21	35	24	40	X ² = 0.320 (0.706)
- Female	39	65	36	60	
Marital status					
- Single	1	1.7	0	0	F = 1.81 (0.729)
- Married	46	76.7	50	83.3	
- Widow	10	16.7	8	13.3	
- Divorced	3	5	2	3.3	
Education					
- Illiterate	29	48.3	24	40	F = 4.85 (0.305)
- Read & write	7	11.7	16	26.7	
- Primary	11	18.3	8	13.3	
- Secondary	10	16.7	8	13.3	
- University	3	5	4	6.7	
Residence					
- Urban	17	28.3	26	43.3	X ² = 2.93 (0.127)
- Rural	43	71.7	34	56.7	
Occupation					
- Farmer	4	6.7	7	11.7	F = 2.99 (0.579)
- House wife	31	51.7	32	53.3	
- Unemployed	12	20	6	10	
- Retired	5	8.3	5	8.3	
- Commercial work	8	13.3	10	16.7	
Monthly income					
- Sufficient	14	23.3	8	13.3	X ² = 2.04 (0.238)
- Not sufficient	46	76.7	52	86.7	
Who is live with you?					
- Alone	3	5	9	15	F = 4.26 (0.928)
- With husband/wife	47	78.3	30	50	
- With the children	10	16.7	21	35	

F (Fisher exact)

X² (Chi square)

*Statistical significant difference (P ≤ 0.05)

Table (1): Illustrated that (63.3% and 50.0%) of the study and control group were aged between (65 < 70 years) and (65%) and (60%) of both groups respectively were females. Also, it was found that (76.7%) of study group and (83.3%) of the control group were married, (48.3%) & (40%) of both groups respectively were illiterate. Additionally, (71.7%) & (56.7%) of them respectively had lived in rural regions. Regarding occupation, (51.7%) & (53.3%) of study and control group were house wives respectively, and the highest percentages of both groups had insufficient monthly income. Finally, no statistical significant differences were found between the study and control groups regarding their demographic data.

Table (2): Percentage Distribution of Study and Control Group Regarding their Medical Data (n=120)

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Medical Data	Study Group (n=60)		Control Group (n=60)		Sig test (P value)	
	No	%	No	%		
Duration of diabetes						
- from 1 to 5 years	13	21.7	8	13.3	X ² = 0.594 (0.747)	
- from 6 to 10 years	23	38.3	20	33.3		
- More than 10 years	24	40	32	53.3		
Diabetes treatment						
- Oral hypoglycemic agents	14	23.3	9	15	X ² = 1.41 (0.523)	
- Insulin	36	60	42	70		
- Insulin and oral hypoglycemics	10	16.7	9	15		
Compliance of used medications						
- Yes	42	70	38	68.3	X ² = 0.333 (0.701)	
- No	18	30	22	36.7		
Chronic disease added to diabetes ≠						
- No	19	31.7	16	26.7	F = 2.38 (9.821)	
- Yes	41	86.3	44	73.3		
Types of chronic disease						
- Hypertension	16	26.7	20	33.3		
- Chronic Respiratory disease	6	10	3	5.0		
- Hepatic disease	3	5	1	1.7		
- Renal disease	4	6.7	2	3.3		
- Cardiac disease	5	8.3	6	10		
- Osteoarthritis	13	21.7	11	18.3		
- Osteoporosis	5	8.3	7	11.7		
Smoking						
- Yes	13	21.7	9	15	X ² = 0.891 (0.480)	
- No	47	78.3	51	85		
Family history of peripheral artery disease						
- Yes	12	20	8	13.3	X ² = 0.960 (0.327)	
- No	48	80	52	86.7		
Family History of Diabetes						
- Yes	25	41.7	32	53.3	X ² = 1.63 (0.273)	
- No	35	58.3	28	46.7		

≠ means more than one answer F (Fisher exact) X² (Chi square) *Statistical significant difference (P ≤ 0.05)

Table (2): Revealed that (40% and 53.3%) of the study and control groups had diabetes for more than ten years. Also, (60 % and 70%) treated with insulin, (70%) & (68.3%) of them respectively complied with their medication. Regarding chronic diseases, it was found that (86.3%) & (73.3%) of study and control group had chronic diseases plus to diabetes. Also, it was observed that (78.3%) & (85%) from study and control group were none smoker, and (80 %) & (86.7 %) of them didn't have family history of peripheral artery disease. In addition, it was found that (41.7%) & (53.3%) of study and control group respectively had family history of diabetes mellitus. No statistical significant differences were found between the study and control group regarding their medical data.

Table (3): Percentage Distribution of Study and Control Group Regarding their total score of Knowledge about Diabetes and foot care (n=120)

	Before Intervention		Post 1 month		Post 2 months		Friedman test (P value)
	Study Group (n=60)	Control Group (n=60)	Study Group (n=60)	Control Group (n=60)	Study Group (n=60)	Control Group (n=60)	
	No (%)	No (%)	No (%)	No (%)	No (%)	No (%)	
- Not satisfactory	56 (93.3)	55 (91.7)	4 (6.7)	54 (90)	4 (6.7)	53 (88.3)	
- Satisfactory	4 (6.7)	5 (8.3)	56 (93.3)	6 (10)	56 (93.3)	7 (11.7)	
	0.120 (0.729)		57.3 (0.001**)		98.6 (0.001**)		

**Statistical significant difference (P ≤ 0.05)

** Highly Statistical significant difference (P ≤ 0.01)

Table (3): Shows a significant improvement of study group knowledge about diabetes, the table revealed that only (6.7%) of them had a satisfactory level of knowledge before intervention, while (93.3%) of them had a

significant improvement level of knowledge about diabetes post 2 months after intervention. In contrast (8.3%) of the control group had a satisfactory level of knowledge before intervention compared to (11.7%) post 2 months.

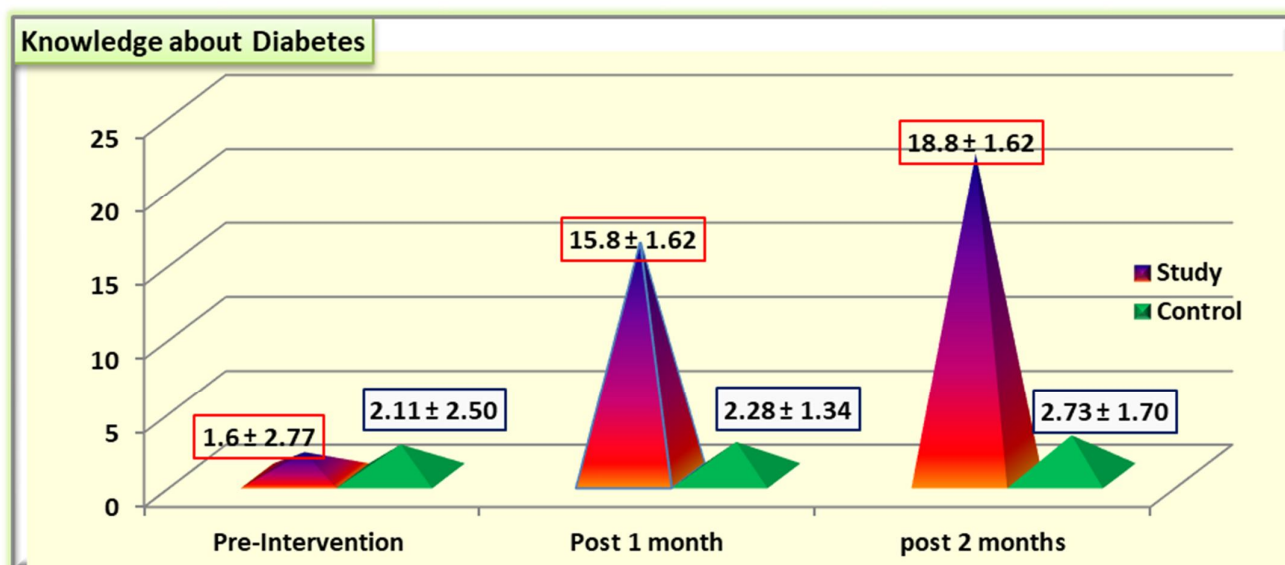


Figure (1) Total Mean Score of Knowledge about diabetes and foot care among the Study and Control Group at pre and posttests (n=120)

Figure (1): Showed a significant improvement in the total mean score for the study group's knowledge regarding diabetes and foot care to be (15.8 ± 1.62) and (18.8 ± 1.62) at posttests as compared to (1.6 ± 2.77) before the intervention. This answered the formulated research hypothesis.

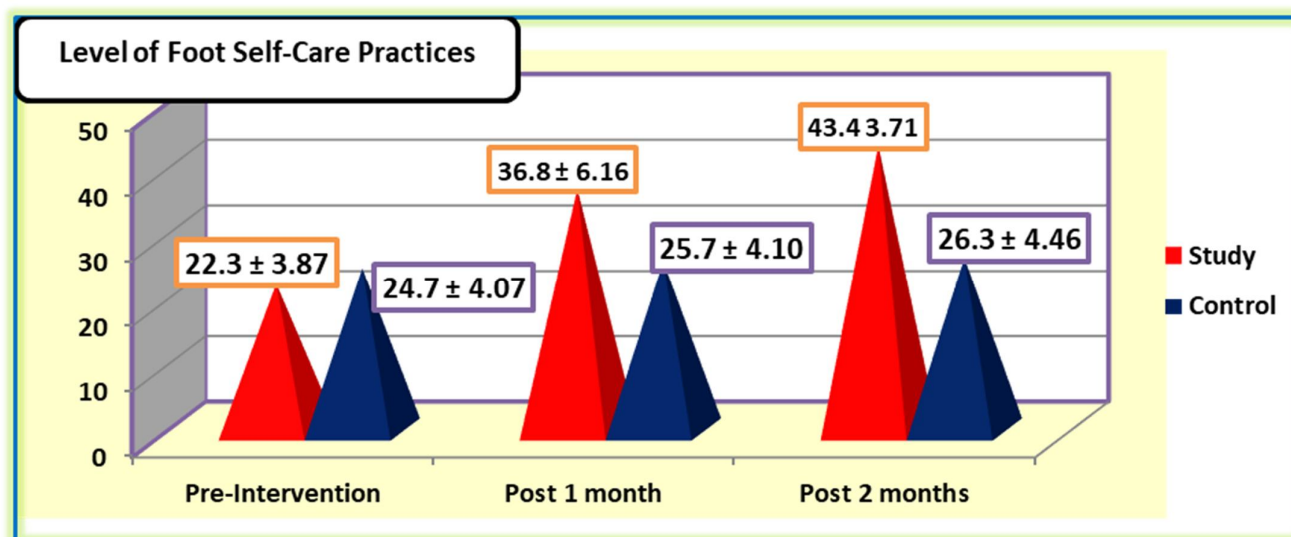


Figure (2) Total Mean Score of Nottingham Assessment of Functional Foot Care Scale among the Study and Control Group before and after the Educational Protocol (n=120).

Figure (2): Shows that the total mean score for foot self-care practices among the study group was (22.3 ± 3.87) at pre/test then it was elevated to be (36.8 ± 6.16) and (43.4 ± 3.71) at follow up phases (after one month and two month) respectively after the implementation of the educational nursing protocol, with a high statistical significant difference between study and control group. This figure answers our research hypothesis.

Table (4): Comparison between the Study and Control Group Regarding to their Total Score of Peripheral Perfusion Assessment for Lower Extremities (n=120)

	Before Intervention		Post 2 months		Friedman test (P value)
	Study Group	Control Group	Study Group	Control Group	
	No=60 (%)	No=60 (%)	No=60 (%)	No=60 (%)	
Total score of right Leg Perfusion assessment scale					
Good (0 – 4)	26 (43.3%)	23 (38.3%)	39 (65%)	27 (45%)	9.13 (0.001*)
Slightly Poor (5 – 9)	25 (41.7%)	30 (50%)	18 (30%)	26 (43.3)	
Poor (10 – 14)	9 (15%)	7 (11.7%)	3 (5%)	7 (11.7)	
X ² (p value)	4.03 (0.257)		90.7 (0.001**)		
Total score of left leg perfusion assessment scale					
Good (0 – 4)	25 (41.7%)	23 (38.3%)	37 (61.7%)	28 (48.7%)	12.17 (0.001**)
Slightly Poor (5 – 9)	29 (48.3%)	32 (53.3%)	19 (31.7%)	28 (46.7%)	
Poor (10 – 14)	6 (10%)	5 (8.3%)	4 (6.7%)	4 (6.7%)	
X ² (p value)	0.033 (0.855)		84.4 (0.001**)		

**Statistical significant difference ($P \leq 0.05$)

** Highly Statistical significant difference ($P \leq 0.01$)

Table (4): Represents that the study group exhibited sufficient (good) peripheral perfusion with percentages of (65%) and (61.7%) for right and left leg respectively after 8 weeks of applying the Buerger Allen exercise as compared to (43.3% & 41.7%) before, with a highly statistical significance difference ($P \leq 0.01$) was detected between the two groups

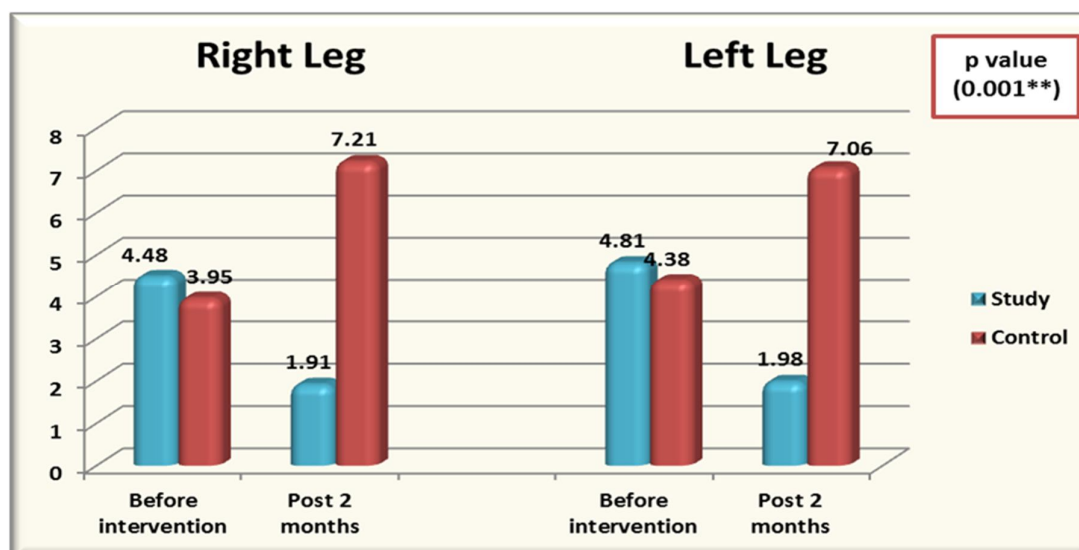


Figure (3) Mean Score of Study and Control Group Regarding their Peripheral Circulation Assessment for Lower Extremities (n=120)

Figure (3) it was found that the mean score of perfusion insufficiency of right leg was 4.48 for the study group before the applying of the burger Allen exercise and this mean deteriorated to be 1.91 after 2 months of the intervention. Also, for the left leg, the mean of perfusion insufficiency was 4.81 among the study group at pretest and upgraded to be 1.98 at posttest. This indicates the affirmative effect of **Buerger Allen Exercise in reducing peripheral perfusion insufficiency and this answered the research hypothesis.**

Discussion

Diabetes is the most common chronic disease among older adult associated with high incidence of foot problems that negatively disturb overall quality of elders' life. Adherence to self-care practices is vital for inhibiting diabetic foot. Preventing foot complications is a part of nursing care focuses on educating the elderly patients and their care givers about foot self-care practices included the Buerger Allen exercise (Kolbay, et al., 2024).

Regarding demographic characteristics and current medical data of the study sample:

The results of the current study revealed that the majority of the elderly participants were aged between (65) and (70) years. This can be explained that with increasing age the persons are liable to a great risk for the development of type II diabetes due to physiological changes occurs with aging process such diminish function of pancreas and increasing insulin resistance, also, the risk of peripheral arterial

disease among patients with type 2 DM increasing with the aging process. Also, it was noted that over three-quarters of the study group and the control group were married. This result was similar to the study by **Garbuja & Ranamagar (2023)** which was reported that the majority of individuals with diabetes mellitus (DM) were in the age range of (60) to (70) years; more than thirty four of participants were married.

The existing study revealed that over fifty percent of the participants in both groups were female, the researcher detected that women are higher prevalence of diabetes due to overweight (high lipid level), insulin resistance increases during menopause, women with a history of gestational diabetes mellitus, unhealthy life style, Additionally, hormonal changes following menopause, particularly the decline in estrogen levels, heighten the risk of developing diabetes mellitus. Estrogen is known for its anti-aging effects, including antioxidant properties, and oxidative stress is recognized as a significant contributor to micro vascular diseases, this is a return to the fact that women earlier diagnosed with DM.

Also found that about less than half of both groups were illiterate, this may be explained as in the past the most people no interested with education resulting in widespread illiteracy and ignorance among diabetic patients. Such a lack of awareness regarding diabetes and its essential care has contributed to an increase in complications, particularly peripheral vascular disease, which can ultimately lead to amputations.

This result was supported by **Elabasy et al., (2024)** who found that half of the studied sample consisted of females. Additionally, stated that two third of the older patients included in the study were found to be illiterate.

The result of the current study revealed that more than two third of elderly patients lived with their spouses and this result is similar to **Correia, et al., (2023)** mentioned that two thirds of participants live with their wife, husband, or partner.

The finding of the current study revealed that the majority of samples were lived in rural areas, more than two thirds of the study group & more than half of the control group, also regarding occupation; it was found that more than half of the study samples were house wives. **From the researcher point of view**, the highest percentages of elderly individuals were found in rural area, where there is limited access to medical services and social media, a lack of awareness regarding healthy behaviors related to disease management. These factors contribute to a

reduced opportunity for acquiring knowledge from external sources and increase the likelihood of developing complications.

This result is in harmony with **Barman, Das, & Verma, (2023)** found that about two third of the elderly of study sample were living in rural areas and more than two third was currently not working.

The current study found that less than one third of sample hadn't any chronic diseases. These findings disagreed with these reached by **Patel et al., (2022)** revealed that, about two third of study sample of type 2 diabetes associated with other chronic illness as hypertension, renal problem, cardiac problem.

Concerning compliance of medications it was found that majority of the studied patients complied with their medication. This study agreed with **Atolagbe et al., (2023)** reported that highest percentage of the subjects were adherence to diabetes medication.

As regards to history of peripheral artery disease the results of the present study revealed that, the vast majority of sample hadn't family history of peripheral artery disease. This finding contradicted with **Bundó et al., (2023)** mentioned that, two third of participants had peripheral artery disease.

Concerning the knowledge level, the results showed that less than one quarter of study group had a satisfactory level of knowledge before education, compared to the vast majority of them had a significant improvement level of knowledge post 2 months after education. In contrast with control group that less than one quarter of them had the same UN satisfactory level of knowledge before and post 2 months.

From the researcher point of view poor level of knowledge among the studied sample before education could be related to several reasons such as cognitive impairment related aging process, lack of community-based campaigns, and ignorance to use of social media platforms, absence of healthcare providers instruction, and illiteracy of the patients that had a negative effect on them to gained new information that effect on behaviors toward self - care.

This agreed with **Eid Zaki, et al., (2023)** who reported that there was no statistically significant difference between study group and control group regarding patient's knowledge about diabetes mellitus during pre-guidelines implementation, but immediate and post 1 month of guidelines implementation, more than two third of the study group had improvement knowledge compared to no

for the control group there was statistically highly significant difference between both groups.

Abd El ghani Hamzway, et al., (2022) mentioned that more than one half of diabetic elderly had poor knowledge pre applying educational program, compared to more than three fourth of them had good knowledge and improvement in total practices about diabetes foot care post applying program.

Regarding to foot self-care practice, the majority of the study group had poor foot self care practice level before education and compared to the vast majority of the same group had improvement level of practice post 2 months of implementing the educational protocol. In contrast with the control group had the same poor practice level along time of the study.

This might be explained by the fact that low level of adequate foot self-care practice might be related to the elderly patients themselves as low education, monthly income, living condition as rural area and limited functional abilities related to aging process. Also, providing good information to the study patient result in a positive effect on better behavior regarding care, also demonstrations and repetition steps of foot self-care make them more skilled in performing foot self-care and prevent development of complications.

These finding consistent with **Fathoni, et al., (2024)** who found that, a highly percentage of elderly patients had poor level of knowledge, lack of foot care skills before receiving foot care educational program. Also, after education the majority of sample had increase level of knowledge about foot care and good foot skill practice Posttest.

Concerning Nottingham Assessment of Functional Foot Care Scale (NAFFC) the current finding represented that the majority of the study group had improvement level of practice in all steps of foot care, **from the researcher's point** of view this fact may be due to received appropriate education by healthcare professional about foot self-care practice that improved the knowledge level and increasing awareness of diabetic elderly patients to reduce the incidence of complications. Also, this practices costless for elderly diabetic patients.

These finding was consistent with the study by **Amrullah, et al., (2024)** who illustrated that education had a significant effect improving knowledge of diabetic patients about foot self-care practice. Also told that about two third of patients inspected their feet daily and sometimes wear shoes without socks post education, washed their feet

daily, and majority of them often checked their shoes before putting them, dry their feet after washing.

It was noticed from the current study that there was no statistically significant relation between both groups regarding socio demographic data and medical data and total practice of foot care except with the educational level. **From the researcher's point of view**, the educational level of elderly may have a positive effect on their attitudes towards foot self-care practices which emphasized understood steps of foot care and had enable to apply it correctly, also educated patient easier to read and understand colored illustrated booklet contained information about their disease and follow healthy life style, foot self-care which decreasing the occurrence of foot ulcer and any complication.

These findings are consistent with **Amer Abdelhay, et al., (2023)** who reported that, there were no statistically significant relation between patient's foot self-care practices and all their demographic characteristic except their educational level there was statistically significant relation ($p>0.05$). Also reported that, there was highly statistically significant positive correlation between total knowledge of the studied sample and their total self-care practices regarding foot care.

This result followed **Agunanne, et al., (2024)** who told that, there was a statistical significant improvement in the knowledge and foot self-care practice among the study group after implementation of an educational program about diabetic foot care.

The current study shows that a highly statistical positive correlation between knowledge of study group regarding diabetes and foot self-care practice post 2 months of implementing the educational program. From the researcher point of view elderly patients who received information by health care professional's increases level of knowledge about foot self-care which significantly influences good practice than those who no received foot self-care information. Also, mostly of patients will be alert to avoid the occurrence of diabetic foot that faster end of their life and they were have increased in the awareness of the performing foot self-care correctly.

These findings are consistent with **Omotosh, et al., (2024)** who reported that a strong association between poor level knowledge about foot self-care and practice among diabetic patients were related to lack of received diabetic foot care health education program.

The current study illustrated that more than two third of the studied sample had a significant

improvement in total score of peripheral perfusion assessment for lower extremity perfusion following a two-month of implementing of educational protocol of BAE for both right and left legs. This result was consistent with **Adel Ebada El Sayed et al., (2021)** who showed that that more than three quarters of the studied subjects have normal pulses, capillary refill and there were statistically significant improvement between post 1 and post 2 after Buerger- Allen exercise implementation means scores in both legs respectively.

From the researcher's point of view, the improvement in lower extremity perfusion as related to received good education about postural period of exercise performance that helps in improvement of collateral circulation perfusion of lower extremity which and decrease appearance of peripheral neuropathy symptoms among diabetic elderly patients. Also, this suggests that the ongoing application of the Buerger-Allen Exercise BAE method over an extended period may be beneficial.

Another study carried out by **Abbass et al., (2024)** supported the present study, showed that showed significant improvement in peripheral circulation perfusion after Buerger-Allen Exercise (pre-intervention 0.6883 ± 0.10980 , post-intervention 1.0250 ± 0.10968).

Hassan, et al., (2020) mentioned that there was a highly statistical significance relations among the study group and their post assessment of the selected clinical feature of peripheral vascular disease PVD levels post application of Buerger Allen exercise for six weeks.

Conclusion:

In the light of current study, it was concluded that the study group of diabetic elderly patient's showed positive significant improvement in foot self-care practices as well as peripheral perfusion of lower extremities after exposure to educational nursing protocol as compared to control group.

Recommendations:

Based on the findings of the current study the following recommendations were suggested

- Continuous educational sessions is recommended to be provided for diabetic elderly patients on foot self-care practices as well as benefits and technique of applying Buerger Allen exercise focusing on the importance of adherence to the exercise to be as a part of care in all health care settings.

- A simplified teaching handouts and posters about foot self-care practices in simple Arabic language should be available in medical outpatient clinics and department of all health care settings.
- A training course is suggested for nursing staff in medical department and outpatient clinics of Minia university hospital to ensure methods of adequate foot assessment, foot care and peripheral perfusion examination for diabetic patients, as well as about the correct application of the Buerger Allen exercise.
- Results needed to be replicated to a large probability sample size that involves participants and nurses from geographic regions in Egypt

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