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Educational needs for Prevention of Peripheral Neuropathy Deterioration in Diabetic patients

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Abstract
Background: Diabetic peripheral neuropathy (DPN) is a chronic, major complication of diabetes, assessment of patients' educational needs plays important role in inhibiting and decreasing the risk of disabilities and lower limp amputation among these patients. **Aim:** To determine educational needs for prevention of peripheral neuropathy deterioration in diabetic patients. **Research question:** What are the educational needs for prevention of peripheral neuropath deterioration in diabetic patients? **Research design:** A descriptive research design had been utilized to conduct this study. **Subjects:** seventy adult, type I diabetes mellitus, stage II DPN enrolled in this study. **Setting:** This study was conducted in the vascular surgery department at Main Assiut University Hospital. **Two tools** were utilized for data collections: **Tool I:** Patient assessment sheet, and **Tool II:** Nursing educational needs questionnaire sheet. **Results: S**hows that the mean age of studied patients was 55.20±8.00. 62% had sever degree of DPN in their right side 55% had moderate degree of DPN in their left side. Regarding educational needs about prevention of DPN deterioration; 52.9% had high level of knowledge; 25.7% had moderate level, and 21.4% had low level of knowledge. **Conclusion:** It was concluded that more than half of patient had adequate level of knowledge, while the second half of patients had inadequate level of knowledge regarding their educational needs about DPN deterioration prevention. **Recommendation:** A multidisciplinary diabetic neuropathy education should be accessible for prevention of DPN stages deterioration**.**

Kkeywords: Diabetic, Deterioration Prevention, Educational needs & Peripheral Neuropathy.

Introduction

The incidence of peripheral neuropathy is expected to increase correspondingly**.** According to international statistics, around one third of the diabetic patients have DPN. National data in Egypt confirmed that 29.3% of Egyptian diabetic patients suffer from DPN. The global estimates of DPN prevalence vary widely from 9.6 to 88.7% in different populations. According to international prevalence studies; the etiology of diabetic foot is mainly DPN; in around 87% of the cases. National Egyptian studies match the international studies' statistics. In local diabetic foot clinics, most of the cases are caused by DPN **(Kisozi et al., 2017; Amara et al., 2019 & Aldana et al., 2021).**

Diabetic Peripheral Neuropathy (DPN) is a common complication of diabetes, which can lead to foot ulcers, amputations, and mortality among patients; it is defined as "the presence of symptoms and/or signs of peripheral nerve dysfunction in patients with diabetes after the exclusion of other causes. The cause of DPN is multifactorial, peripheral nerve damage is due to the long standing hyperglycemia and diabetes-related micro vascular complications resulting in a decrease in nutrition especially to the nerves of the feet **(Mirghani et al., 2021).**

The clinical risk factors for DPN include metabolic changes, higher glycosylated hemoglobin and longer duration of diabetes, higher levels of total and low-density lipoprotein cholesterol and triglycerides, cardiovascular disease, higher body-mass index, higher urinary albumin excretion rate, hypertension and smoking **(Kelkar, 2020 & Secorún et al., 2021).**

Staging system has been developed for neuropathy to provide a framework for diagnosis and management. It classified into grades as follow: Stages 0/1: no clinical neuropathy No symptoms or signs), Stage 2: clinical neuropathy (Chronic painful, Acute painful, Painless with complete/partial sensory loss & Diabetic amyotrophic), Stage 3: late complications of clinical neuropathy (Foot lesions, e.g. ulcers, Neuropathic deformity, e.g. Charcot joint & Non-traumatic amputation) (**Yang et al., 2018).**

Nurses play a basic and important role in reducing and preventing foot ulcers, lower limb amputations and disabilities related to DPN complication through educational interventions, this include glycemic control, lifestyle modifications, physical exercise,

reduce exposure to toxins and quit smoking, healthy diet, Stress management, and foot care. All health professionals involved in caring for patients with DPN have a responsibility to ensure safe delivery of patient care in accordance with local and national clinical guidelines **(Kassar & Khudur, 2021).**

Significance of the study:

Diabetic peripheral neuropathy affects 10–50% of people with diabetes mellitus **(Burgess et al., 2021).** It is the most common chronic micro vascular complication of Diabetes mellitus. From the researcher's clinical experience, it has been observed that many patients admitted to the vascular surgery department with a late stage of neuropathy. DPN is a preventable disease through enhanced education about glycemic control. In the current study the researcher assessed patients' educational needs about diabetic peripheral neuropathy deterioration prevention.

Aim of the study:

To determine educational needs for prevention of peripheral neuropathy deterioration in diabetic patients.

Research question:

What are the educational needs for prevention of peripheral neuropathy deterioration in diabetic patients?

Patients and Method:

Research design:

A descriptive research design was utilized in this study.

Setting:

This study was carried out in the Vascular Surgery department at main Assiut University Hospital.

Sample:

A total of seventy (70) adult patients had diabetic peripheral neuropathy admitted to vascular surgery department at main Assiut University Hospital during six month period from August 2021 to January 2022.

Inclusion criteria:

All patients that their age ranges from 18- 65 years, male and female who diagnosed with type 1 DM, stage 2 diabetic peripheral neuropathy, chronic lower limp ischemia stage II & III, lower limbs affection, were willing to participate in the study.

Exclusion criteria:

Type 2 DM, stage 0/1 & 3 of diabetic peripheral neuropathy, neuropathy due to trauma, malignancy, toxic (e.g. alcohol), metabolic (e.g. vitamin B deficiencies), autoimmune, infective (e.g. HIV), with sub-acute sensory neuropathy and Patients undergoing dialysis.

Tools of the study:

To collect relevant data for this study, two tools were used.

Tool I: Peripheral neuropathy patient assessment sheet:-

It was developed by researcher based on national and international literature review. It was consisted of four parts:

Part 1: Patients' demographic data;

It included patients' codes, age, gender, marital status, residence, working status and educational level.

Part 2: Health history;

It assessed current and past health history of studied patients such as Diabetes duration, treatment, smoking, alcohol intake, co-morbid condition …etc.

Part 3: Clinical neurological examination scale (CNE);

This scale is a clinical scoring system was adopted from (**Yang et al., 2018**) in this study to assess severity of DPN; it measures sensory signs and reflexes in the lower limbs. It involves clinical testing of sensory dysfunction (pinprick, light touch, vibration, and position sense) of the feet, the anatomic level below which light touch sensation is impaired, muscle strength of the feet and ankle reflexes.

Scoring of this part (part III):

The total score of the CNE is 33 points. A score of zero can be graded as no neuropathy, one to nine (1:9) as mild, (10: 18) as moderate, and (19: 33) as severe DPN.

Part 4: Laboratory investigations and diagnostic studies;

This part included laboratory investigation and diagnostic studies such as, HbA1c value, complete lipid profile, blood sugar, CBC, and etc.).

Tool II: Peripheral neuropathy nursing educational needs questionnaire sheet:-

This tool was structured by researcher based on national and international literature review to assess patients' educational needs about DPN deterioration prevention which consisted of different types of questions (objective and essay) regarding the following items: disease process, glycemic control, healthy diet, exercise and foot care.

Scoring of this tool (too II):

The sum score of questions translated in results into high level, moderate level, and low level, patients who obtained score (>70%) were considered having high level of knowledge, and patients who obtained score (from 50% to 70%) were considered having moderate level of knowledge. While those who obtained score (< 50%) were considered having low level of knowledge.

Procedure:

This study was carried out in two phases:

Preparatory phase,:

Tools development:

It included reviewing current and past, national and international related literature and theoretical knowledge of various aspects of the study using books, articles, internet, periodicals, and magazines to develop tools for data collection **(Saltar & Sahar, 2020 ; Bairaktaridou et al., 2021 and Ziegler et al., 2021)**

Content validity and reliability:

It was established by panel of five expertise (4 teaching staff of Medical Surgical Nursing, Faculty of Nursing, Assiut University, & one Assistant Professor of Vascular Surgery, Faculty of Medicine, Assiut University) who reviewed the tool for clarity, relevance, comprehensiveness, understanding, applicability and easiness, minor modification were required.

Reliability of the tools was measured by Cornbrash's alpha coefficient; it was (0.824).

Pilot Study:

A pilot study was conducted on 10% of patients (7 patients) to evaluate the clarity, feasibility, and applicability of the tools. The data obtained from the pilot study was analyzed. There was no change. Patients participated in the pilot study were excluded from the main study.

Ethical Consideration:

Permission to carry out the study was obtained from the ethical committee of the Faculty of Nursing. An official letter was issued from the dean of the Faculty of Nursing to the head of Vascular Surgery department to collect the necessary data. The aim of the study was explained to nursing staff and surgeons to gain their cooperation. In addition; verbal permission was obtained from patients or their families that were willing to participating in the study after explanation of the nature and purposes of the study. Confidentiality and privacy was assured. Patients had the right to refuse to participate and/ or withdraw from the study without any rationale at any time.

Implementation phase:

Fieldwork Phase

- Data were collected during the period from Augusts 2021 and ended January 2022 .
- Data were collected from the Vascular Surgery department .
- The researcher greeted the patients, introduced herself and purpose of study was explained to patients who agreed to participate in the study prior to any data collection.
- The tools filled through interviewing. The researcher was attending two days/week from 8 am to 2 p.m.
- Each Patient had assessed for demographic data, health history, clinical neurological examination, laboratory investigations using tool I part I, II, III and IV. Also each patient had assessed for his or her educational needs about DPN deterioration prevention using tool II.
- After finishing assessment; the researcher clarified misunderstanding and false knowledge for each patient.

Statistical analysis :

Data collected from the studied sample was revised, coded and entered using Personal Computer (PC). Computerized data entry and statistical analysis were fulfilled using the Statistical Package for Social Sciences (SPSS) version 22. Data were presented using descriptive statistics in the form of frequencies, percentages and Mean SD. A correlation coefficient "Pearson correlation" is a numerical measure of some type of correlation, meaning a statistical relationship between two variables. Statistical significance was defined as $P<0.05$. Chi Square test statistic is commonly used for testing relationships between categorical variables.

Results:

Table (1): Number and percentage distribution of the studied patients according to their socio-demographic characteristics (n=70).

Personal information	N	%
Age		
30-<40	2	2.9
40-<50	14	20.0
50-<60	22	31.4
≥60	32	45.7
Mean x S.D 55.20±8.00		
Gender		
Male	42	60.0
Female	28	40.0
Residence		
Urban	44	62.9
Rural	26	37.1
Level of education		
Uneducated	8	11.4
Read and write	12	17.1
Primary educated	21	30.0
Secondary education	25	35.7
University education and above	4	5.7

Table (2): Number and percentage distribution of the studied patient according to clinical data (n=70)

Items	N	%
Diabetes duration		
20-<40	20	28.5
40-<60	48	68.6
≥60	2	2.9
Mean x S.D 44.91±8.12		
Body mass index/ Weight status		
Normal	8	11.4
Over weight	38	54.3
Obese	24	34.3
Affected side		
Right side	36	51.4
Left side	30	42.9
Bilateral	4	5.7
Smoking history		
Current smoker	16	22.9
Quit smoking	10	14.3
Never smoked	44	62.9
***Comorbid conditions**		
Hypertension	50	71.4
Cardiovascular disease	38	54.3
Dyslipidemia	26	37.1
Nephropathy	4	5.7
Retinopathy	4	5.7
HbA1c (%) value (mmol/L)		
Controlled	21	30.0
Uncontrolled	49	70.0
Blood Sugar		
A –Fasting (mg/dL)		
Normal	4	5.7
High	66	94.3
B- Random (mg/dL)		
Normal	4	5.7
High	66	94.3
TG (mg/dL)		
Normal	15	21.4
High	53	75.7
Low	2	2.9

**More than one answer*

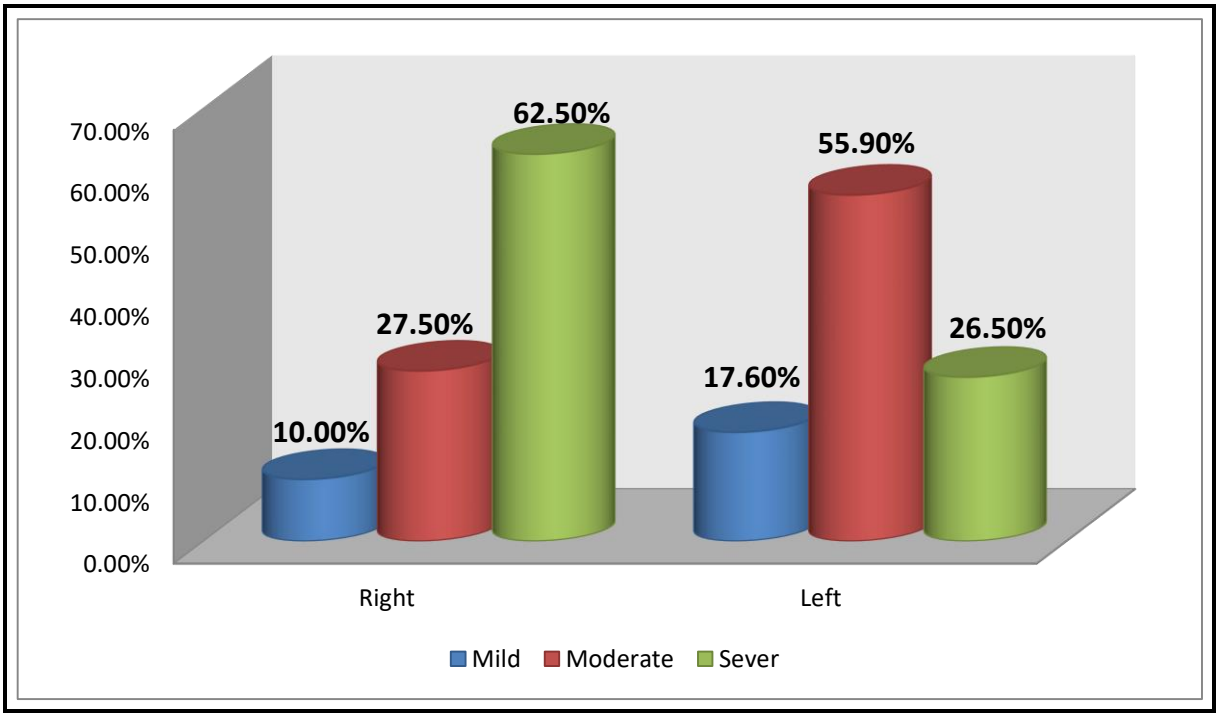

Figure (1): Percentage distribution of the studied patients according to the severity of diabetic peripheral neuropathy (CNE) (n=70)

Table (3): Number and percentage distribution of the studied patients according to their educational needs about diabetic peripheral neuropathy deterioration prevention (n=70).

Educational needs about DPN	Level of knowledge					
Items	High		Moderate		Low	
	No	%	No	%	No	%
• **Knowledge about disease process**	42	60.0	17	24.3	11	15.7
• **Knowledge about glycemic control**	41	58.6	14	20.0	15	21.4
• **Knowledge about healthy diet and exercise**	33	47.1	28	40.0	9	12.9
• **Knowledge about foot care**	38	54.3	19	27.1	13	18.6
Total	**37**	**52.9**	**18**	**25.7**	**15**	**21.4**

Table (4): Correlation between total items of peripheral neuropathy nursing educational needs (n=70).

Items of educational needs about DPN		Correlation between items				
		1	2	3	4	5
1. Total knowledge about disease process	r p					
2. Total knowledge about healthy diet and exercise	r p	.841 .000**				
3. Total knowledge about glycemic control	r p	.543 .000**	.580 .000**			
4. Total knowledge about foot care	r p	0.474 0.001**	.549 .000**	.660 .000**		
5. Total peripheral neuropathy nursing educational needs	r p	0.697 0.002**	0.525 .000**	.651 .001**	.699 .000**	

(**) Statistically significant at p<0.01. r Pearson correlation

Table (1): Clarifies that the mean value of studied patients' age is $\bar{x}$ S.D 55.20±8.00 years old. More than half of them (60.0%) are males. According to residence nearly two thirds of them (62.9%) are from urban area. As regard their educational level, more than one third of them (35.7%) have secondary education.

Table (2): Shows that the mean value of diabetes duration among studied patients was $\bar{x}$ S.D 44.91±8.12 years. Regarding their body mass index/ weight status, more than half of them (54.3%) are overweight. According to their affected side; more than half of them (51.4%) has affected right side. Nearly two thirds of them (62.9%) never smoke, but less than one quarter of them (22.9%) is current smokers. Furthermore, almost three quarters of them (71.4%) have hypertension and more than half of them (54.3%) have cardiovascular disease. Regarding their laboratory data; more than two thirds of them (70.0%) have uncontrolled HbA1c, most of them (94.3%) have high fasting and random blood sugar and more than three quarters of them (75.7%) have high TG.

Figure (1): Reveals that; nearly two thirds of studied patients (62.5%) have sever diabetic peripheral neuropathy in their right side, while more than half of them (55.9%) have moderate diabetic peripheral neuropathy in their left side.

Table (3): Illustrates that; more than half of studied patients (52.9%) have high level of knowledge regarding educational needs about diabetic peripheral neuropathy deterioration prevention. More than one quarter of them (25.7%) have moderate level of knowledge and (21.4%) of them have low levels.

Table (4): Shows highly statistically significant positive correlations ($p< 0.01$) between all total items listed as regard educational needs about diabetic peripheral neuropathy deterioration prevention

Discussion

Diabetic Peripheral Neuropathy (DPN) is a common complication of diabetes, which characterizes by many clinical manifestations and can lead to foot ulcers, amputations, and mortality among diabetic patients **(Hamme et al., 2020 & Mirghani et al., 2021).**

The current study was designed to assess nursing educational needs needed for peripheral neuropathy deterioration prevention among diabetic Patients.

As regard demographics of the studied patients

The current study discovered that the mean age of studied patients was 55.20±8.00 years old. In the researcher's point of view; diabetes is a degenerative disease that appears slowly along with the increasing age of the patients so that patients will experience complications of diabetes with long duration of diabetes. These findings are inconsistent with the study performed by **(Kisozi et al., 2017)** who found the mean age for DPN was 54.1 years old. Also, the result was in the line with **(Dikici et al., 2017)** who reported the mean age for diabetic patients with DPN was 60 years. Furthermore **(Hamme et al., 2020)** reported that the mean age of participant was ranged from seventy years to seventy- two years.

As regard gender the current study revealed that more than half of the studied patients were males. This finding may be due to female a tending to seek medical services more than men this help them for early detection and prevention of diabetic complication. This finding is reinforced by the main findings of **(Baba et al., 2019 & Barbara et al., 2020)** who found that more than half of studies from males. On the other hand, inconsistent with the main studies conducted by **(Metin & Arslan, 2018 & Jorgetto et al., 2021)** who founds the more than half of the studied cases were females.

As regarding to residence nearly two thirds of them are from urban area**.** This finding may be due to bad habits of this population like lack of physical activity and walking this increase risk for exposures to obesity and D.M complication. This finding was in the same line with **(Kisozi et al., 2017)** who mentioned that, more than two thirds of them were residents from urban areas.

Concerning the level of education, the current study revealed that more than one third of the studied patients had secondary level education. This may be due to missing desirability of complete university education because lack of public office and high cost of university education. This finding was not comparable to many studies conducted by **(Kisozi et al., 2017 & Jorgetto et al., 2021)** who founds more than half of studies patient had only primary level education. Also, this finding was incongruent with the study performed by **(Metin & Arslan 2018)** who found more than one third of the studied patients had primary level education.

As regard clinical data.

According to diabetes duration the current study discovered that the mean value of diabetes duration was more than forty years. This finding could be interpreted in the light of fact that they related to the long-term deleterious effects of diabetes on the peripheral nerve in the lower limb. This could be explained by increasing diabetes duration which stimulates the degeneration process and causes nerve cell damage and causes changes in both large nerve fibers and small nerve fibers that gives rise to vulnerability in elderly to neuropathy.

This discovery was supported by (**Lee, 2017)** who stated that the duration of diabetes mellitus was over 15 years and progression of neuropathy depends on the duration of diabetes mellitus. In addition this results was supported by **(Pfannkuche et al., 2020)** who found longer duration of diabetes (sixty years) and prevalence of DPN increases for type I diabetes melitus. especially after 5 years of diabetes diagnosis. On the other hand, these results are incongruent with

the study conducted by **(Sallam & Edison, 2019)** who found that less than half of studied patients had duration of diabetes mellitus from (5 – 10 years).

Regarding their Body mass index more than half of studies patient are overweight. This might be due to lack of physical activity and bad dietary habits in the studies patients. In accordance with our result by **(Sallam & Edison, 2019)** supported this finding as they stated that more than half of the studied group had high body mass index (BMI).

Regarding smoking history the result of the present study revealed that the two thirds of studies patients are never smoke, but less than one quarter of them is current smokers. The researcher believes that these results may be due to a lack of sufficient awareness in the smoker groups about harmful effect of smoking on the glycemic control also, smoking is a major contributor to the incidence of DPN due to the deleterious effects that it induces on the peripheral nerves. This finding was agreement with **(Sallam & Edison, 2019)** who reported that the majority of the studied patients have never smoked.

As regard comorbid condition, almost three quarters of studied patients have hypertension and so more than half of them have cardiovascular disease. The researcher believes that these results may be due hypertension and cardiovascular disease leads to a complex set of pathways inter linking nerve function and energy production with a dysfunctional neural vascular supply. These result agree with **(Pfannkuche et al., 2020)** who mentioned that significantly more comorbidities, such as nephropathy, retinopathy, hypertension and heart disease. Likewise **(Barbara et al., 2020)** supported the result as they stated that the hypertension is independently associated with DPN.

Regarding laboratory data more than two thirds of them have uncontrolled HbA1c, most of them have high fasting and random blood sugar and more than three quarters of them have high triglyceride (TG). The researcher believes that these results may be due to a lack of sufficient follow up of diabetic laboratory investigation related to high cost of investigation. The findings of this study were consistent with those of a study conducted by **(Sallam & Edison, 2019)** who found that the more than two third of the studied group had high fasting blood sugar and had high glycosylated hemoglobin (HbA1C).

Also, this finding was in line as **(Lee, 2017)** who stated that there mean HbA1c was more than 8.4%, suggesting that diabetic complications such as neuropathy are progressing. In addition this study result was consistent with **(Barbara et al., 2020)** who stated that higher mean HbA1c was the most significant risk factor for DPN. **(Pfannkuche et al., 2020)** supported the above finding as they add the present of higher HbA1c, fasting blood sugar and elevated triglycerides among the patient with DPN. Like same previous studies by (**Bus et al., 2019)** who reported that the elevated triglycerides were a risk factor for DPN, while lower High-density lipoproteins (HDL) cholesterol levels increased DPN.

As regard to severity of diabetic peripheral neuropathy.

Regarding clinical neurological examination (CNE) score it reveals that, nearly two thirds of studied patients have sever degree in their right side, while more than half of them have moderate diabetic in their left side. The same result was supported by **(Amelia et al., 2019**) which reported more than one third of the studied patient have normal and less than half of them have mild neuropathy, while less than one quarter have moderate neuropathy according to CNE scoring system.

As regard to educational needs about diabetic peripheral neuropathy deterioration prevention.

In the light of study, the result revealed that, more than half of studied patients have high level of knowledge about disease process. In addition more than half of them have high level of knowledge about glycemic control while less than half of them have moderate level of knowledge about healthy diet and exercise but less than one quarter of them have low level of knowledge about foot care.in the researcher's point of view. This may be due to inattention of patients to seek health education from the diabetic education centers in the hospitals, lack of regular medical care and poor health seeking behavior.

In accordance with the our results **(Bauer et al., 2018)** support this finding as they stated that self-care activities generally related to diabetes such as healthy diet and blood glucose monitoring as well as foot exams that are of special relevance to patients with DPN. Furthermore, for foot exams, the results suggested a trend for a greater increase in this self-care activity. Likewise (**Secorún et al., 2021)** pointed that the exercise, in all its modalities, is beneficial for patients with diabetic neuropathy. Furthermore, the findings of this study were consistent with those of a study conducted by **(Bhaskar et al., 2019)** who found that the more than one quarter had poor knowledge regarding diabetic foot care.

Also, the pervious finding was supported by **(Yacout, 2016)** as they demonstrate nearly less than half of the studied sample had poor total knowledge related diabetic foot self-care. The result in the same line with **(Mohmed et al., 2018**) who stated giving health education to clients with diabetic peripheral neuropathy can help improving their knowledge, and practices subsequently leading to promoting life style

and prevention diabetic peripheral neuropathy complication.

Also, this finding matches that of **(Ren et al., 2014)** who reported that the intensive education could draw patients' attention to the control of diabetes and was beneficial to the prevention and cure of risk factors of diabetic foot diseases (Such as plasma glucose, blood lipids, blood pressure, etc.), which play indirect roles in the prevention of foot ulceration. After patients received intensive nursing education, the blood pressure, fasting blood glucose, and HbA1c levels were all decreased significantly, and the high-density lipoprotein cholesterol level was improved more than before education.

This amplification is in line with **(Abdulrahman et al., 2020)** who found that more than two third of participants had good knowledge and attitude regarding diabetes and showed a significant association between the level of education and knowledge Practicing regular exercise was significantly associated with better knowledge, attitude, and practice in studies Participant. This slightly differ from (**Kisozi et al., 2017)** the study demonstrated high knowledge scores in the pretest which may be due to the medical nature of the participants, but also there was a significant difference after implementation.

On the opposite side the result is incongruent with our result by **(Sallam & Edison, 2019)** as they stated that the total knowledge about foot care among studied group revealed that no one of the studied sample had satisfactory level of knowledge about foot care pre intervention but the majority of them had satisfactory level of knowledge about foot care one week after intervention and three months after intervention.

As regard correlation between the studied variable.

The present study revealed that, there were highly statistically significant positive correlations ($p<0.01$) between all total domains listed as regard peripheral neuropathy nursing educational needs**.** In investigator point of the view this finding may be due to the patient knowledge about disease process can increase patient awareness' about glycemic control, healthy diet and exercise and foot care. This finding was comparable to one found in a research by **(Sallam & Edison, 2019)** which revealed that there was a highly statistically significant positive correlations improvement on patient's knowledge about diabetic peripheral neuropathy at all knowledge items post one week and post three months of intervention.

This explanation goes in the same line as **(Mohmed et al., 2018**) who mentioned that the total knowledge score level before program implementation nearly majority had unsatisfactory knowledge while after program implementation most of the study sample had satisfactory knowledge. Like some previous studies by **(Mahdi & Hasan, 2011)** who find the positive correlation between the foot-care knowledge scores and behavior score is suspected as it confirms the importance of foot care education and improving knowledge are the first steps in improving foot care practice in our patient.

Conclusion:

Based on the findings of the current study, it was concluded that more than half of patient had adequate level of knowledge, while the second half of patients had inadequate level of knowledge regarding their educational needs about DPN deterioration prevention.

Recommendation:

Based on findings of the current study, the following items are recommended:

- A multidisciplinary diabetic neuropathy education about (disease process, glycemic control, healthy diet, exercise and foot care) should be accessible for prevention of deterioration of DPN stages.
- Replication of the same study on a larger probability sample at different geographical locations for data generalizability.

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