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Pain, Functional Limitation and Sleep Pattern Among Diabetic Geriatric Patients with Peripheral Neuropathy

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ABSTRACT

Background: *Diabetic peripheral neuropathy is one of the most debilitating complications of diabetes mellitus th leading to disability especially among geriatric patients .* ***Aim:*** *Assess pain, functional limitation and sleep pattern amo diabetic geriatric patients with peripheral neuropathy. A descriptive research design was utilized in this study* ***Settin*** *Geriatric outpatient clinic of the specialized Medical Hospital at Mansoura University . A convenience sample of 155 geriati patients who met the inclusion criteria were enrolled in the study. Four tools were used to collect data; Structured Intervie Schedule, Health Related Data, Douleur Neuropathique 4 Questionnaire , Screening Activity Limitation and Safety Awarene Scale and Pittsburgh Sleep Quality Index. Neuropathic pain, poor sleep quality were prevailing among the studied diabe peripheral neuropathy geriatric patients with 89% and 84.5% respectively . Also,29% of the studied diabetic geriati patients had severe functional limitation .A highly statistically significant positive relation Was found between neuropath pain, functional limitation and sleep quality.* ***Conclusion:*** *The majority of the studied diabetic peripheral neuropathy geriati patients had neuropathic pain, functional limitation and poor sleep quality.* ***Recommendation:*** *Designing an educatio program on diabetic peripheral neuropathy among geriatric patients through emphasizing on its management and healt lifestyle.*

Keywords: *Geriatric Patients ,Pain, functional Limitation ,Sleep Pattern ,diabetic peripheral neuropathy.*

Introduction

Diabetes Mellitus (DM) is a global illness that is spreading to more and more people from all walks of life without distinction. Hyperglycemia and glucose intolerance, which are linked to decreased insulin production and peripheral sensitivity, as well as eventual β-cell failure, are the cornerstones of diabetes mellitus, a metabolic disease (Amin et al., 2025).Diabetes Mellitus (DM) is also associated with high morbidity due to a broad range of complications. One significant contributing reason to disability in geriatric patients is peripheral neuropathy. Diabetes mellitus is the most prevalent cause of peripheral neuropathy in developed nations (Simo, et al., 2020).

Diabetic peripheral neuropathy is a condition where an increase in blood glucose damages the nerves, causing a decrease in blood flow to the cells and a reduction in nerve cell function(Tesfaye & Didangelos, 2024). The primary sign and symptom of diabetic neuropathy is symmetrical sensory pain in the lower limbs. Patients with this condition first experience pain in their lower limbs. Additional manifestations of nerve motor dysfunction include muscle weakness, poor balance, and a tendency to fall, as well as unusual discomfort, numbness, pins and needles, and burning sensations (Galiero et al., 2023).

Neuropathic pain, sometimes referred to as a shooting or scorching pain, is pain brought on by an injury or illness of the central somatosensory nerve system. Although it is frequently persistent, it might go on its own. Geriatric patients may experience weakness, cramping, or a loss of coordination if the motor nerves that affect stability and movement are damaged (Shrivastava & Ye, 2022).The existence or lack of neuropathic pain is most likely caused by a complex interplay between psychological, sensorial, and genetic factors. Painful DN is more likely to occur in women. A higher body mass index, poor glycemic management, renal dysfunction, and the severity of the neuropathy are risk factors for neuropathic pain and are linked to the progression of the neuropathy (Quiroz-Aldave, et al ., 2023**).**

Functional limitation, which is defined as any impairment in physical function when performing various everyday tasks like walking, taking a shower, or shopping, is one of the most significant health-related issues for diabetes geriatric patients (Gao, Du, Cai, & Hu, 2023). Diabetes mellitus is associated with a two-fold increased risk of functional limitations and disability in geriatric . This involves disabilities in daily activities as well as restrictions in general

physical activities, leisure, and social activities, as well as mobility tasks involving the lower extremities (Thomson, 2024).

Sleep is a vital bodily physiological function. It offers advantages including mental and physical rest, awareness on both the intellectual and physiological levels, preparing for taking on new responsibilities, and the ability to repair the body. Reduced sleep has numerous negative effects, including heart disease, diabetes, depression, falls, accidents, cognitive impairment, and a lower quality of life (Foster, 2022).

A multidisciplinary team approach is necessary for the management of diabetic neuropathy. As a vital component of this team, nurses have a number of duties, including educating people about diabetic neuropathy and neuropathy risk, planning interventions for high-risk populations, and ensuring that they acquire the necessary information and behaviors (Görgülü et al., 2022). When it comes to managing diabetes in elderly people, the gerontological nurse is crucial. Nurses must be adept in determining a geriatric patient's risk of developing diabetes and keep an eye out for any changes or symptoms (Anastasi & Klug 2021).Therefore, this study was carried out to assess pain , functional limitation and sleep pattern among diabetic geriatric patients with peripheral neuropathy.

Aim of the Study

The aim of the study was to:

Assess pain, functional limitation and sleep pattern among diabetic geriatric patients with peripheral neuropathy.

Research Questions

1) What is the characteristics of neuropathic pain among diabetic geriatric patients with peripheral neuropathy?
2) What is the level of functional limitation among diabetic geriatric patients with peripheral neuropathy?
3) What is the sleep pattern among diabetic geriatric patients with peripheral neuropathy
4) What is the relationship between pain, functional limitation and sleep pattern among diabetic geriatric patients with peripheral neuropathy?

I. Study Design

A descriptive research design was utilized to carry out this study.

II. Study Setting

This study was conducted at the outpatient clinics of the Specialized Medical Hospital at Mansoura University, namely Diabetes and Endocrine glands clinic working during all the week ; Diabetic foot clinic working Sunday-Monday-Tuesday-Wednesday and Diabetic Neuro clinic working each Wednesday .The hospital consists of five floors, and the outpatient clinics are located on the ground floor

III. Study Subjects

A convenience sample of **(155)** geriatric patients attending the previous mentioned setting and were selected according to the following criteria:

Inclusion criteria:

1- Aged 60 years and more
2- Both sexes.
3- Able to communicate.
4- Accept to participate in the study.

Sample size calculation

Based on data from literature ***(*Abo-Elfetoh et al., 2022*),*** considering level of significance of 5%, and power of study of 80%, and based on data from literature, the sample size can be calculated using the following formula:

$$n = \frac{\left(Z1 - \frac{\alpha}{2}\right)^2 . SD^2}{d^2}$$

Where, $Z_{1-\alpha/2}$ = is the standard normal variant, at 5% type 1 error it is 1.96, SD = standard deviation of variable and d = absolute error or precision. So,

$$n = \frac{(1.96)^2 . (2.35)^2}{(0.37)^2} = 154.9$$

Based on the above formula, the total sample size required for the study was 155 diabetic geriatric patients with peripheral neuropathy.

IV. Tool of Data Collection

In order to collect the necessary data four tools were used:

Tool I: Structured Interview Schedule

It was developed by the researcher after review of relevant literature (Gregg et al., 2021) (El Hefnawy, Ramadan, Rabie, & Effat, 2022)and divided into two parts:

Part I: **Demographic Characteristics of Diabetic Geriatric Patients** It indmdes age, sex, marital status, level of education, occupation before retirement, current occupation, income and living condition.

Part II: **Medical History Related Data**: It involved questions about duration of DM ,family history of DM, duration of diabetic peripheral neuropathy, Blood glucose checkup , number of chronic diseases, history of chronic diseases , type of diabetic drug therapy regimen and other medications taken daily.

Tool II: Douleur Neuropathique 4 (DN4) Questionnaire

It was developed by Bouhassira, et al., (2005) to assess characteristics of pain among diabetic peripheral neuropathy geriatric patients. It was translated into Arabic language by the researcher. The reliability of tool II was done by Cronbach Alpha test =0.735. The DN4 tool consists of 10 items grouped into four questions: seven items relating to the pain description (burning, painful cold, electric shocks) and its associated abnormal sensations (tingling, pins and needles, numbness, itching), and the other three items relating to a brief bedside neurological examination in the painful area [touch hypoaesthesia using a soft brush, pinprick hypoaesthesia using disposable examination pins, tactile dynamic allodynia using a soft brush.

Tool III: Screening Activity Limitation and Safety Awareness (SALSA) Scale

This tool was developed by SALSA Collaborative Study Group, (2007) to assess functional limitation among diabetic peripheral neuropathy geriatric patients .It was translated into Arabic language by the researcher. The reliability of tool III (SALSA Scale) was 0.881. It consists of 20 items of daily activities related to the three domains of mobility, self-care, and work. For each question, the participant answered "yes" or "no". If the answer was positive, the interviewer should investigate the level of ease in which could be performed the activity addressed in the question, whether "easy" is given 1 ,"a little difficult" is given 2 or "very difficult" is given 3 .For negative answers, the interviewer should also investigate why the patient could not perform the assessed activity, where the patient could classify the motivation into "I don't need to do this" is given 0 ,"I physically can't" is given 4 and I avoid because risks is given 4.

Tool IV: **The Pittsburgh Sleep Quality Index (PSQI)**:

This scale was developed by Buysse, et al, (1989). It is an effective instrument used to measure the quality and patterns of sleep in geriatric patients . It was translated into Arabic language and approved to be valid and reliable by (Rajoub, 2015). The reliability of this tool was tested using test retest reliability Spearman's correlation coefficient r=0.83. It differentiates poor from good sleep by measuring seven domains: subjective sleep quality, sleep latency (i.e., how long it takes to fall asleep), sleep duration, habitual sleep efficiency (i.e., the percentage of time in bed that one is asleep), sleep disturbances, use of sleeping medication, and daytime dysfunction. The patient self-rates each of these seven areas of sleep.

V. Data Collection Process:

The process of data collection was going through two phases:

Phase I: Preparatory phase:

- **Administrative step** in which official letter was obtained from the Vice Dean of the College of Nursing for Postgraduate Studies and Research, Mansoura University and was directed to Vice Dean of the College of medicine for Postgraduate Studies and Research, Mansoura University. Then the letter was directed to the manager of Specialized Medical Hospital to obtain his approval for carrying out the study.
- Tool I (Structured Interview Schedule) was developed by the researcher based on a review of related literature.
- Tool II (Douleur Neuropathique 4) Questionnaire, and tool III (Screening Activity Limitation and Safety Awareness Scale) were translated into Arabic language by the researcher. An expert in the English language from the English Department, Faculty of Education, and Mansoura University employed back translation to confirm the accuracy of the tool translation.
- The Arabic version Tool IV (The Pittsburgh Sleep Quality Index) was utilized in this study.

Validity of the tool:

The study tools were tested for its content validity by a jury of seven experts in the fields of gerontological nursing Mansoura University. Accordingly, their recommended modifications were done(i.e., changing in the ordering and sequences of some sentences and paraphrasing of some sentences ,adding question about use of assistive devices& question about type of diabetic drug therapy regimen) and the final forms were used for data collection.

Reliability of the tool:

The reliability of Tool II (DN 4) Questionnaire, and tool III (SALSA Scale) were done by Cronbach Alpha test. The reliability of tool II (DN 4) Questionnaire, and tool III (SALSA Scale) were 0.735, & 0.881 respectively.

Phase II: Operational phase:

- The data collection covered the period of three months from the start of December of 2023 to the end of February 2024.
- The researcher started data collection when the necessary approval was obtained.
- Study participants who fulfill sampling criteria and accept to participate in the study were interviewed individualized; then the researcher introduced herself and given an explanation of the purpose of the study to collect the necessary data using all study tools.
- The researcher visited Specialized Medical Clinic for 3 days per week (Sunday-Monday - Wednesday) from 9 A.M. to 2 P.M.
- The researcher visited Diabetic Foot Clinic on(Sunday-Monday) from every week, while visited Diabetic Neuro clinic each Wednesday from 9a.m. to 2p.m.
- The researcher managed to interview geriatric patient and the time needed to fill the interview schedule was 20-30 min for every patient according to geriatric patient level of understanding and their cooperation. The number of patients with peripheral neuropathy interviewed by the researcher per day ranged from 4 to 5.

Data Analysis

All statistical analyses were performed using SPSS for windows version 20.0 (SPSS, Chicago, IL). Continuous data were normally distributed and were expressed in mean ±standard deviation (SD). Categorical data were expressed in number and percentage. Statistical significance was set at $p<0.05$.

VI. Ethical considerations of the study:

- An ethical approval was taken from the Research Ethics Committee of the Faculty of Nursing – Mansoura University with reference number .355.
- An informed consent was obtained from each geriatric patient enrolled in the study after providing comprehensive information about the nature of the study.
- Privacy of the studied geriatric patients and confidentiality of their collected data were assured and were only used for the purpose of the study.
- Each of the studied geriatric patient was assured that the participation was voluntary, and they were informed that they have the right to withdraw from the study at any time without any consequences or penalty.

Results

Table1: Showes that 54.8% of the studied diabetic geriatric patients aged from 60 years to less than 65, while only 24.6% aged from 65 to less than 70 years with a mean of 65.60±5.22 years. Regarding sex , females were more prevalent in this study that represented 60% of the studied diabetic geriatric patients while 40% of were males. Illiteracy was prevailing among 40.6% of the studied diabetic geriatric patients .As regard to living arrangement , 81.3% were living with their families .

Table 2: reveals, that 54.2% of the studied diabetic geriatric patients have diabetes mellitus from10 years or more .Additionally ,32.3% of the studied diabetic geriatric patients reported that they were suffering from diabetic peripheral neuropathy from1 year to less 3year. Furthermore 74.8% of the studied diabetic geriatric patients had other chronic diseases. Regarding frequency of blood glucose checkup 40% of the studied geriatric patients checkup blood glucose monthly .In addition, 58.7% of the studied diabetic geriatric patients take less than 5 medication .As regard family history of DM 70.3 % of the studied diabetic geriatric patients reported that they have family history of DM.

Figure 1:displays that 89% of the studied diabetic geriatric patients were suffering from neuropathic pain while, only 11% weren't suffering from neuropathic pain with a mean of ***6.42±2.34.***

Figure 2: Illustrates that 29% of the studied diabetic geriatric patients had sever functional limitation while, 24.5% had moderate functional limitation ,22.6% had mild functional limitation ,20.6% had extreme functional limitation while only 3.2% had no functional limitation.

Figure 3: displays that 84.5 % of studied diabetic geriatric patients had poor sleep quality while 15.5 % of had good sleep quality with total PSQI mean of10.17±4.37.

Table 3: reveals that presence of neuropathic pain was a statistically significantly higher among the studied diabetic geriatric patients who have diabetes from ten years or more (p= 0.001**) .Also, presence of neuropathic pain was

statistically significant among the studied diabetic geriatric patients, who have diabetic peripheral neuropathy from more than five years and presence of other chronic disease p= (0.038* , 0.45*) respectively.

Table 4:illustrates that functional limitation was a highly statistically significant among the studied diabetic geriatric patients who aged ≥70 years , who living alone , who have diabetes from ten years or more, who have diabetic peripheral neuropathy from more than five years ,who have other chronic diseases , who take five medications or more (p= 0.007**, 0.008**, 0.008**, 0.001**, 0.006**, <0.001**) respectively.

Table 5 : displays that sleep quality was a highly statistically significant among the studied diabetic peripheral neuropathy geriatric patients who aged ≥70 years , who have diabetes from ten years or more, who have diabetic peripheral neuropathy from more than five years (p= 0.007** 0.002**,0.003**) respectively.

Sleep quality was statistically significant among the studied diabetic peripheral neuropathy geriatric patients who living alone, who have other chronic disease and who take less than five medications p=(0.031*,0.030* ,0.011*) .

Table 6: shows correlations matrix between the study variables .It illustrates that, there was a highly statistically significant positive relation between neuropathic pain, functional limitation and sleep quality (p= $<0.001^{**}$, $<0.001^{**}$,$<0.001^{**}$) respectively. In which increased neuropathic pain was associate with increase functional limitation, poor sleep quality and vice versa.

Table 1: Demographic Characteristics of the Studied Diabetic Peripheral Neuropathy Geriatric Patients (N=155)

Demographic Characteristics	n= 155	100%
Age (years)		
From 60 to less than 65 years	85	54.8
From 65 to less than 70 years	38	24.6
70 years and more	32	20.6
Mean ± SD (Min – Max)	65.60±5.22 (60-87yrs)	
Sex		
Male	62	40.0
Female	93	60.0
Educational level		
Illiterate	63	40.6
Read and write	35	22.6
Primary education	27	17.4
Secondary education	26	16.8
University education	4	2.6
Living arrangements		
Alone	29	18.7
With the family	126	81.3

Table 2: Distribution of the Studied Diabetic Peripheral Neuropathy Geriatric Patients According to Their Medical History Related Data

Medical History		n (155)	100%
Duration of diabetes mellitus			
Less than 5 years		25	16.1
From 5 to less than 10yrs		46	29.7
10 yrs or more		84	54.2
Mean ± SD		13.09±7.03 (3-35yrs)	
DPN duration			
From less than one year	48	31	
From 1year to less than 3 years	50	32.3	
From 3year to less than 5 years	32	20.6	
More than 5 years	25	16.1	
Presence of other chronic diseases			
Yes		116	74.8
No		39	25.2
Frequency of blood glucose checkup			
Daily		33	21.3
Weekly		27	17.4
Monthly		33	21.3
More than month		62	40.0
Number of medications are taken			
Less than 5 medications		91	58.7
5 medications and more		64	41.3
Family history of DM			
Yes		109	73.3
No		46	29.7

Diabetic Peripheral Neuropathy (DPN)

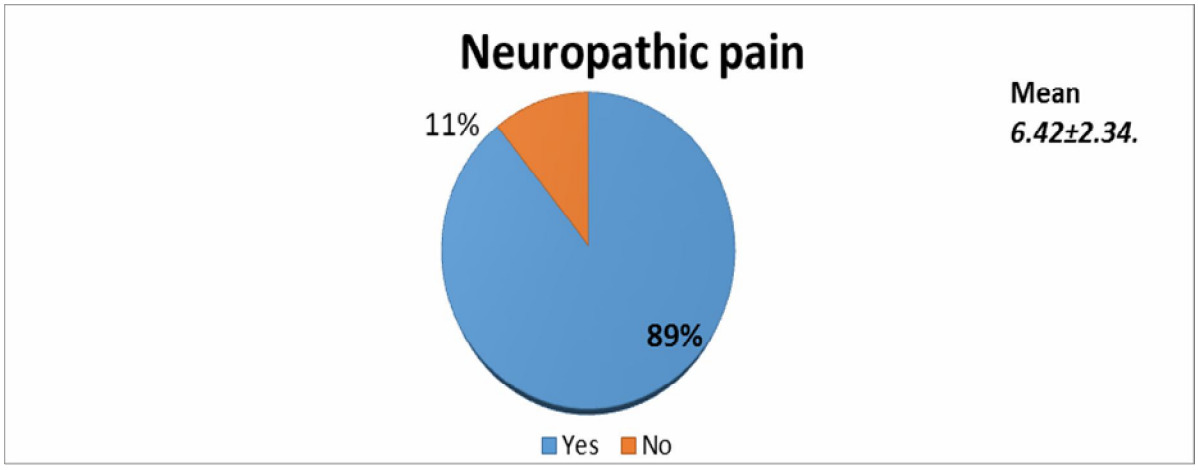

Figure 1: Distribution of the Studied Diabetic Peripheral Neuropathy Geriatric Patients According to Presence of Neuropathic Patients.

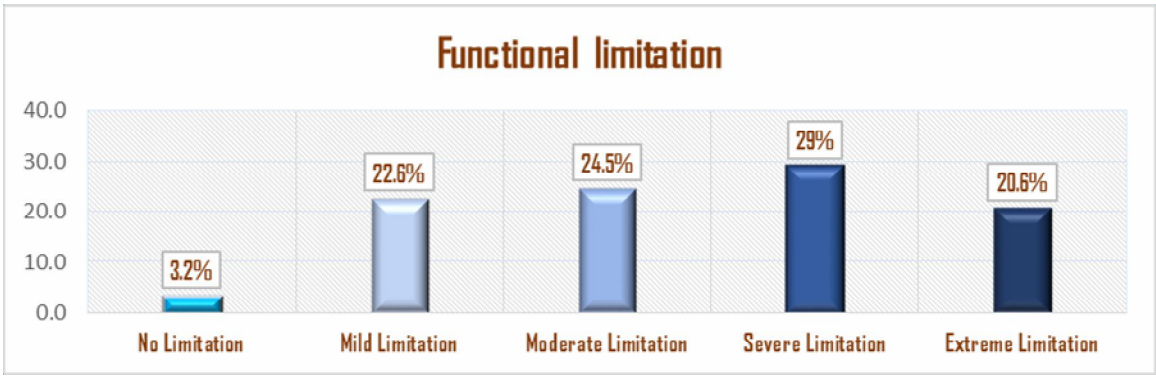

Figure 2 Distribution of the studied diabetic peripheral neuropathy geriatric patients according to level of functional limitation

Figure 3 : Distribution of the Studied Geriatric Patients with Peripheral Neuropathy According to their Sleep Quality Using Pittsburgh Sleep Quality Index

Table 3 : Relation Between Presence of Neuropathic Pain and Medical History Related Data of the Studied Diabetic Peripheral Neuropathy Geriatric Patients

Variable		Presence of neuropathic pain				Test of significance	
		No		Yes			
		n	%	n	%	X^2	P
Duration of DM	Less than 5yrs	8	32.0	17	68.0	14.639	0.001**
	From 5 < 10yrs	5	10.9	41	89.1		
	≥ 10 yrs	4	4.8	80	95.2		
DPN duration	< 1 year	10	20.8	38	79.2	8.398	0.038*
	1 < 3 yrs	4	8.0	46	92.0		
	3 < 5 yrs	3	9.4	29	90.6		
	> 5 years	0	0.0	25	100.		
Presence of other chronic disease	Yes	3	2.6	113	97.4	3.106	0.45*
	No	15	38.5	24	61.5		

Table 4: Relation Between Functional Limitation, Demographic Characteristics and Medical Related Data of the Studied Diabetic Peripheral Neuropathy Geriatric Patients.

Variable		Functional limitation	Test of significance	
		Mean ± SD	F/t	P
Age (years)	60 < 65 years	46.28±11.74	5.089	0.007**
	65 < 70 years	49.34±13.90		
	≥70 years	55.38±18.07		
Living arrangeme	Alone	55.17±13.64	2.700	0.008**
	With the family	47.47±13.90		
Duration of DM	Less than 5 yrs	43.20±10.88	4.946	0.008**
	From 5 < 10 yr	46.43±12.85		
	≥ 10 yrs	51.96±14.98		
DPN duration	< 1 year	45.65±11.53	5.723	0.001**
	1 < 3 yrs	45.70±14.14		
	3 < 5 yrs	52.28±14.87		
	> 5 years	57.28±14.04		
Presence of other chronic disease	Yes	50.72±14.04	2.803	0.006**
	No	43.54±13.18		
Number of medications	< 5 medication	45.54±11.99	3.682	<0.001**
	≥5 medications	53.70±15.60		

Table 5: Relation Between Sleep Quality ,Demographic Characteristics and Medical Related Data of the Studied Diabetic Peripheral Neuropathy Geriatric Patients.

Variable		Sleep Quality	Test of significance	
		Mean ± SD		
Age (years)	60 < 65 years	5.94±2.29	5.163	0.007**
	65 < 70 years	6.61±2.14		
	≥70 years	7.44±2.44		
Living arrangements	Alone	7.74±2.43	2. 196	0.031*
	With the family	6.25±2.11		
Duration of DM	Less than 5 yrs	4.92±2.25	8.597	0.002**
	From 5 < 10 yrs	6.17±2.2		
	≥ 10 yrs	6.99±2.25		
DPN duration	< 1 year	5.69±2.32	4.911	0.003**
	1 < 3 yrs	6.2±2.16		
	3 < 5 yrs	6.81±2.47		
	> 5 years	7.72±2.07		
Presence of other chronic disease	Yes	7.58±2.29	2.514	0.030*
	No	5.92±2.46		
Number of medications	< 5 medications	7.01±2.33	2.590	0.011*
	≥5 medications	6.98±2.27		

Diabetic Peripheral Neuropathy (DPN)

Table 6: Correlations Matrix between the Study Variables

Variable		Neuropathic pain	Functional limitation
Functional limitation	R	0.496	1
	P	<0.001**	
Sleep quality	R	0.503	0.594
	P	<0.001**	<0.001**

**. Correlation is significant at the 0.01 level (2-tailed).

r, Pearson Correlation

Discussion

Diabetic Peripheral Neuropathy (DPN)is a common and often debilitating complications of diabetes, particularly prevalent among geriatric patients. Prolonged elevated blood glucose levels cause nerve damage in this disorder, which results in symptoms like pain, tingling, and loss of sensation in the extremities. Geriatric patients with DPN may experience persistent pain that is neuropathic in nature, which can further worsen pre-existing medical conditions (Lu, et al ., 2023).Movement is difficult due to persistent discomfort, which leads to a reduction in physical activity and additional functional limitation. Geriatric patients may have trouble with balance and coordination as their mobility declines, which raises their risk of accidents and falls (Tesfaye & Didangelos, 2024).

Regarding the demographic characteristics ,the present study showed that, the age of the studied diabetic geriatric patients ranged from 60-87yrs ,while more than one half of the studied diabetic geriatric patients were young old. Females were more prevalent in this study, more than one half were married. Furthermore, illiteracy was prevailing among the studied diabetic peripheral neuropathy geriatric patients. This result may be justified as; the majority of the diabetic geriatric patients under study were females . In the past, women were not allowed to pursue higher education or receive any education at all.

In accordance a study conducted in Ethiopia by Negussie & Bekele, (2024) who reported that the majority of diabetic geriatric patients were young old and in Egypt by Mohammed, et al., (2023) who reported that women were more likely than men to have DPN .Also this result agrees with the study conducted in Egypt by Mahmoud et al., (2022) who found more than two third of the participant were married.

Medical history is considered one of the factors affecting the occurrence of diabetic peripheral neuropathy which is crucial in diagnosing and managing diabetic peripheral neuropathy in older individuals. Key aspects of the medical history that are important to consider include the duration of diabetes mellitus, blood glucose level , previous treatments for neuropathy, family history of diabetes or neuropathy, and any other underlying health conditions that may contribute to neuropathy symptoms (Gad et al., 2024).

Furthermore, the current study showed that more than half of the studied diabetic peripheral neuropathy geriatric patients have diabetes mellitus from10 years or more. This result justified by chronicity nature of DM , which longer duration of DM increase risk of DPN. This finding in agreement with studies done in a China by Zhang et al., (2024). In addition , the present study revealed that about two fifth of the studied diabetic geriatric patients checked blood glucose more than month. Similarly, a study done in Egypt by Hegazy et al., (2022) who found most of study take oral hypoglycemic medication &insulin injection. In contrast , a study done in Ethiopia by Negussie & Bekele, (2024).

Regarding family history of DM more than two third of the studied diabetic peripheral neuropathy geriatric patients reported that they have family history of DM . Similar finding of a study conducted in Egypt by Farag et al., (2023) who found that more than half have positive family history of DM.

Neuropathic pain is the most serious complication of DPN. Neuropathic pain is a particularly problematic type of acute or chronic pain, which occurs as a result of damage to elements of the nervous system, including peripheral nerve, spinal cord, and brain . Neuropathic pain has a major impact on patients' quality of life, sleep and mood (Buscarinu, 2022).

Supporting this, the majority of the studied diabetic peripheral neuropathy geriatric patients had neuropathic pain .This finding may be attributed to micro vascular changes that lead to reduced nerve regeneration and reducing blood vessels to nerves that lead to increased pain sensitivity . Similarly ,a study conducted in China by Li et al ., (2023). Another study done in India by Baxi et al.,(2020) who found that neuropathic pain more prevailing among their study participants .

Functional limitation is one of the most significant health issues among diabetic geriatric patients. Functional limitations are closely associated with diabetic peripheral neuropathy, which affects quality of life and may potentially be a predictor of hospitalization even death (Orlando et al., 2022).

Supporting that, most of the studied diabetic peripheral neuropathy geriatric patients had mild, moderate & severe functional limitation. This may be due to presence of neuropathic pain that lead to a significant reduction in ability to perform daily activity .Another interpretation may be due to DPN can contribute to muscle weakness and atrophy, further compromising mobility and strength. This can limit geriatric patients ability to engage in physical activities or tasks that require dexterity and strength.

Similarly ,other studies done in Ghana by Banchani et al.,(2024) who found that severe functional limitation in maintaining ,changing body position, carrying, moving and handling objects and walking also reported lower participation in their interpersonal relationships and a study done in Egypt by Mohamed et al.,(2021) who found less than one half had moderate functional limitation . In the same line, studies done in Brazil by Ernandes et al., (2020).

Sleep is a major predictor of life quality, alterations in sleep that take place as people age have a negative impact on quality of life. Diabetic geriatric patients face several difficulties in their everyday lives and long-term health as a result of sleep disturbances or poor sleep quality (Laverty et al., 2023).The current study clarified that the majority of the studied diabetic geriatric patients had poor sleep quality, while the least of them had good sleep quality and more than one third of the studied diabetic geriatric patients reported fairly bad sleep quality. This result could be attributable to presence of neuropathic pain that interfere with normal sleep pattern .There is a broad agreement with finding in other studies done in Egypt by Alshehri, (2024) who found that more than three quarter of their participants stated that they suffer from poor sleep. Also, a study done in Thailand by Kulpatcharapong et al., (2020)

The current results showed that, presence of neuropathic pain was a statistically significantly higher among the studied diabetic geriatric patients who have diabetes from ten years or more ,who have diabetic peripheral neuropathy from more than five years and who have other chronic diseases. This may due to the progressive damage to nerves caused by prolonged uncontrolled blood glucose levels in diabetes mellitus . Over time, this nerve damage leads to abnormal sensations, such as pain, tingling, or numbness, known as neuropathic pain. The longer duration of diabetes mellitus , the higher the likelihood of developing neuropathic pain due to the cumulative effect of nerve damage over time. Similar finding was reported by a study done Kim & Lee, (2024) ; in China by Li et al ., (2023) ; in Cadiz by Naranjo et al., (2020) who stated that presence of neuropathic pain more prevailing with patient had more than two disease and have diabetes from 15year.

The current study clarified that, functional limitation was a highly statistically significant among the studied diabetic geriatric patients who aged ≥70 years and who living alone. This may due devastating of normal physiological changes on musculoskeletal and nervous system as reduced nerve regeneration and who living alone can exacerbate limitations as there may no immediate assistance in case of fall. This result was in the same line with studies done in Egypt by Mohamed et al.,(2021) ;in East Delhi by Vaish et al., (2020); in America by Fong , (2019). who found that age was significantly associated with functional limitation .

Furthermore the current study showed that, functional limitation was a highly statistically significant among the studied geriatric patients who have diabetes from ten years or more, who have other chronic diseases and who take five medications. Geriatric patients with diabetes for ten years often experience functional limitations due to complications from neuropathy and reduced mobility. Prolonged high blood glucose levels can damage nerves and blood vessels, leading to issues like numbness, muscle weakness, and impaired balance. These functional limitations can affect daily activities and quality of life .In accordance a study done by Shoji et al.,(2024) ; in Egypt by Ahmed et al.,(2023) ;Mohamed et al., (2021) who found statistically significant among the studied geriatric who have diabetes from ten years .

The current study revealed that, there was a highly statistically significant relation among the studied diabetic peripheral neuropathy geriatric patients who aged ≥70 years and living alone .This is in agreement with study done in China by Lee et al., (2022) ; Chu et al., (2022)who found that the risk of poor sleep quality was significantly high among geriatric patients who living alone and increasing age was positively associated with both shorter and longer sleep duration.

Comorbidity is one of the major issues leading to a higher risk of sleep problems in geriatric patient .Sleep complaints increases with an increasing number of health problems (Miner & Kryger, 2020). Additionally, current results showed that, there was a statistically significant relationship between poor sleep quality and number of medications taken . This could be explained by the necessity of using several medications to treat presenting multi chronic diseases at the same time as aging. As the majority of the studied diabetic peripheral neuropathy geriatric patients had more than one disease and some of these medication can disrupt normal sleep on its quantity or quality. This in the same line with a study done study done in Canada by Özkök et al., (2022) ,also a study done in Japan by Tai et al., (2021) and study done in Turkey by Azizoğlu Şen et al., (2021)who showed that potential confounders for poor sleep quality including use of sleep medication

In addition, sleep quality was a highly statistically significant relation among the studied diabetic peripheral neuropathy geriatric patients who have diabetes from ten years or more, who have diabetic peripheral neuropathy from more than five years. This could be explained by increased duration of diabetes is most significant risk factor of DPN. Similarly, a study done in Germany by Pfannkuche et al ., (2020).

Finally, there was a highly statistically significant positive relation between neuropathic pain, functional limitation and sleep quality. This could be explained by patients' neuropathy-related pain might impair movement and general physical activity, which can lead to functional limits. This could further worsen the patient's general health and well-being by impairing sleep quality and making it harder to fall or stay asleep.

This result was in the same line with studies done in Egypt by Mohamed et al., (2021). Also agree with a study done in Delhi by Vaish et al., (2020). It was obvious that increased neuropathic pain was associate with increase functional limitation, poor sleep quality diabetic peripheral neuropathy geriatric patients and vice versa.

Conclusion

Based on findings of the present study, it was concluded that the majority of the studied diabetic peripheral neuropathy geriatric patients had neuropathic pain , functional limitation and poor sleep quality . There was a highly statistically significant positive relation between neuropathic pain, functional limitation and sleep quality. Increased neuropathic pain has been associated with increased functional limitation and poor sleep quality, and vice versa.

Recommendations

1- Designing an educational program on diabetic peripheral neuropathy among geriatric patients through emphasizing on its management and healthy lifestyle

2- Adequately planned in-service training programs for the gerontological nurse related to characteristics of neuropathic pain ,levels of functional limitation and sleep quality among diabetic geriatric patients with peripheral neuropathy patients.

3- Activation the positive role of the mass media in spreading health awareness about diabetic peripheral neuropathy among geriatric patients

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