Effectiveness of Bundles of Nursing Care on Level of Neuropathy Pain among Diabetic Patients

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Abstract - Introduction: Diabetic neuropathy most often damage nerves in patients with diabetes. High blood sugar (glucose) can injure nerves throughout the body. Methods: Quasi Experimental, Non-randomized Control Group design was adopted. Thirty study participants were recruited using non-probability purposive sampling technique. The level of neuropathy pain was assessed using Modified Galer Neuropathy Pain and Semmes - Weinstein Monofilament (10gm) testing. The Bundles of Nursing Care were implemented which included Contrast bath, Isometric exercises and Education on Foot Care Management to the interventional group of diabetic patients. Results and Discussion: The calculated 't' values were 31.5 and 14.2 greater than the given table value at the level and $p < 0.001$ among interventional group on level of neuropathy pain using Modified GNPS and Monofilament respectively. There was a significant association

between the age group of study participants with pretest scores among diabetic patients in interventional group. Conclusion: Bundles of Nursing Care was effective for diabetic patients with neuropathy pain.

Key words: Bundles of Nursing Care, Level of Neuropathy Pain, Contrast bath, Isometric exercises and Foot Care Management.

1.INTRODUCTION

Noncommunicable diseases (NCDs) such as diabetes mellitus (DM) are caused by a combination of physical, genetic, environmental, and behavioral factors in a person, and these diseases can affect an individual irrespective of age and geographical area [1]. Often, diabetes is considered a lifestyle disorder [2] due to behavioral risk factors such as tobacco use, the harmful use of alcohol, physical inactivity, and unhealthy diets contributing to the higher risk of diabetes [1]. Developing countries like India are the second-leading country after China with a high prevalence of diabetes, and about one in six people with diabetes worldwide are in Asia [3]. It is estimated that, in India, there are a 77 million people aged 18 and older from type 2 diabetes, and about 25 million people are in the pre-diabetic stage.

Significant complications due to diabetes include macrovascular complications such as cardiovascular diseases and microvascular complications such as kidney disease, neuropathy, and retinopathy. These complications can cause a high risk for mortality and mortality as an overall decrease in the quality of life for individuals with diabetes [4]. Because of all these ,diabetes requires uninterrupted medical guidance with several interventions to treat the uncontrolled glycemic levels and reduce these complications [5]. However, an important fact to consider is that over 50% of people are unaware of their diabetic status, leading to severe health

complications due to delays in detection and treatment in them [6].

Among the diabetic complications, neuropathic pain is a complication of diabetic neuropathy caused by a lesion or disease of the central or peripheral nervous system [7]. It is found that diabetic patients who suffer from neuropathic pain have a significant impact on their quality of life, sleep, daily activities, and enjoyment of life [8]. About 60 to 70% of people with DM have different forms of damage to their nervous systems, causing mild to severe forms of nerve problems, including numbness, tingling sensations, or burning hands and feet [9].

A multidimensional approach is necessary for effective management and control of diabetes [10] and conditions like diabetes neuropathy require personalized management for treating the neuropathy pain in diabatic patients [7]. There are many alternative therapies that have a significant effect on reducing the level of neuropathy pain including exercise, contrast baths, foot massage therapy, acupuncture, and acupressure [11]. In a routine practice in the health care system, the measures such as educating diabetic patients on foot care management and teaching isometric exercises are there along with contrast bath that are performed by nurses, occupational therapists, and physical therapists [12].

In India, it has been observed that there is a huge variation has been marked in overall awareness and diabetes care across the geographical areas and it is also found that there is underutilization of public health-care services for management of diabetes and its complications [13]. The study also addressed the theme of World Diabetes Day, November 14, 2020, "The Nurse and Diabetes" [14]. The overall focus of the campaign was to promote and focus on the crucial role of health professionals and nurses in the management of diabetic patients. This initiated the idea of putting the right expertise in the hands of nurses to make a difference for the diabetic patients in managing their health concerns [15]. So, we have implemented bundles of nursing care to reduce the level of neuropathy pain in diabetic patients, and methods such as modified Galer Neuropathy Pain Scale (GNPS) and Semmes-Weinstein Monofilament (SWM-10gm) testing were used for the early detection of the level of pain among these diabetic patients.

The study aimed to achieve the following objectives:

- To assess the pre- and post-test level of neuropathy pain among diabetic patients in the interventional and routine care groups.
- To assess the effectiveness of nursing care bundles on the level of neuropathy pain in diabetic patients in the interventional and routine care groups.
- To determine the association between the pre-test level of neuropathy pain and sociodemographic and clinical variables among diabetic patients in the interventional and routine care groups.
- To determine the level of satisfaction regarding the bundles of nursing care in diabetic patients among the interventional group.

2. Body of Paper

MATERIALS AND METHODS

Study design and population

The research adopted a quasi-experimental research design and a non-randomized control group design to understand the effectiveness of bundles of nursing care on the level of neuropathy pain among diabetic patients. The study was conducted among diabetic patients

attending the Physical Medicine and Rehabilitation (PMR) Out-Patient Department (OPD) at PSG Hospitals, Coimbatore. This study setting was selected based on availability of samples, feasibility, and ethical clearance. Patients were allocated to two groups, such as the intervention group and the routine care group, without using any randomization methods.

Sampling and sample size

A non-probability purposive sampling technique was adopted to select the samples for the study which helped to obtain information from the targeted population. Inclusion and exclusion criteria were followed during the selection of study participants for the interventional and routine care group. The sample size for the study was calculated using power analysis and the calculated sample size was 30. Among the 30 participants, 15 samples were assigned to the interventional group and 15 samples were assigned to the routine care group.

Sample selection criteria

Patients diagnosed with diabetes mellitus, aged between 21 and 60 years, and having diabetic neuropathy pain were eligible for the study. The exclusion criteria for the study were patients who had oedema in their leg, foot ulcers or gangrene, intolerance to cold or warm temperatures, or loss of sensation in the foot.

Intervention

The intervention group received bundles of nursing care, including:

- Providing a contrast bath with hot water at 38 degrees celsius for 3 minutes and cold water at 28 degrees celsius for 1 minute, alternatively, for 5 cycles (20 minutes).
- Teaching isometric exercises such as calf stretch, seated hamstring stretch, plantar fascia stretches,

chair squat, seated dorsiflexion, hip extension, and side leg raises via video.

- Educating about foot care management using Power Point

Data collection

The sociodemographic variables and clinical parameters were collected using a structured questionnaire. The assessment of pre- and post-test levels of neuropathy pain among diabetic patients in the interventional and routine care groups was conducted using the modified GNPS and monofilament (SWM-10 gm) before and after the implementation of bundles of nursing care, respectively.

Modified Galer Neuropathy Pain Scale (GNPS): It is a standardized tool developed in 1997 by Galer BS to quantify the severity of the pain of an individual. Scores are based on the patient's responses to questions about pain intensity. This scale contains 10 characteristics, which include intensity of pain, sharpness of pain, level of heat, dullness, coldness, skin integrity, level of itching, quality of pain, overall unpleasantness, and intensity of deep and surface pain. The interpretation was categorized as mild (score 1 to 50), moderate (score 51 to 75), and severe (score 75 to 100). The total score for the level of neuropathy pain is 100.

Semmes-Weinstein Monofilament (SWM-10gm): In 1960, psychologists Florence Semmes and Sidney Weinstein developed a set of nylon monofilaments to measure sensory loss. The SWM-10gm testing is one of the clinical tests that measures the response to a touching sensation of the monofilaments using a numerical quantity. This testing is to assess peripheral neuropathy pain. The assessment is done in 8 sites with scores of 10 and interpreted as severe, moderate, and mild risk.

Figure 1: Sites for Monofilament (SWM-10 gm) testing

The SWM-10gm scores are calculated based on the following markings: 1. first metatarsal; 2. third metatarsal; 3. fifth metatarsal; 4. plantar midfoot; 5. plantar midfoot medial; and 8. first web space, with 1 point each; and 6. plantar midfoot lateral and 7. plantar heel, with 2 points each. The total score is 10, and it is classified as mild (score 0-3), moderate (score 4-6), and severe risk (score 7–10).

Data analysis

The collected data were analyzed using descriptive and inferential statistics based on the objectives and hypotheses of the study. The frequency and percentage were calculated to analyze the sociodemographic and clinical variables for the interventional and routine care groups among diabetic patients. The mean and standard deviation were used to describe the level of neuropathy pain before and after implementing bundles of nursing care among diabetic patients in an interventional group. A paired "t' test was used to test the significant difference in pre- and post-test scores on level of neuropathy pain among diabetic patients in the interventional and routine care groups. A chi-square test was used to find the association of pre-test scores on level of neuropathy pain with the selected background and clinical variables among diabetic patients.

Ethical considerations:

The ethical approvals were taken from the Institutional Human Ethical Committee of PSG Institute of Medical Science and Research to conduct the study. Informed written consent was obtained from all study participants before the data collection and the privacy and confidentiality of the data maintained throughout the study and afterwards.

RESULTS

In this study, the majority of the patients were between the ages of 41 and 60 and had overweight and type 2 diabetes. Almost all (except 2) were suffering from diabetes over 6 months, and many were mainly associated with burning type of pain. The detailed description of sociodemographic and clinical characteristics is given in Table 1.

Table 1: Distribution of diabetic patients in interventional and routine care groups based on sociodemographic and clinical characteristics.

Variable	Sub-category	Intervention group		Routine group	
		n	%	n	%
Age	21 to 40 years	0	0	4	26.7
	41 to 60 years	10	66.7	6	40
	61 to 80 years	5	33.3	5	33.3
Gender	Male	5	33.3	10	66.7
	Female	7	46.6	8	53.4

		n	%	n	%
Education	Primary	4	26.7	2	13.3
	Secondary	3	20	5	33.3
	Higher	4	26.7	4	26.7
	Illiterate	2	26.7	4	26.7
Occupation	Private	1	6.7	4	26.7
	Government	2	13.3	0	0
	Business	3	20	3	20
	Unemployed	9	60	8	53.3
BMI	Normal weight	1	6.7	5	33.3
	Overweight	13	86.6	9	60
	Obese	1	6.7	1	6.7
DM	Type 1	0	0	4	26.6
	Type 2	15	100	11	73.3
Duration of DM	< 2 years	0	0	0	0
	2-5 years	1	6.7	6	40
	> 5 years	14	93.3	9	60
Treatment for DM	OHA	2	13.3	5	33.3
	Insulin	0	0	0	0
	OHA and insulin	13	86.7	10	66.7
	No treatment	0	0	0	0
Comorbidities	Yes	3	20	10	66.7

		n	%	n	%
	No	12	80	5	33.3
Pain in the legs	Yes	15	100	15	100
	No	0	0	0	0
Duration of pain	< 6 months	0	0	2	13.3
	6 months to 1 year	6	40	7	46.7
	>1 year	9	60	6	40
Sensation of pain	Tingling	1	6.7	3	20
	Numbness	3	20	4	26.6
	Burning	11	73.3	8	53.4
Management of leg pain	Topical gel/cream	5	33.3	8	53.3
	Oral tablets	0	0	0	0
	Parental form	0	0	0	0
	Home remedies	10	66.7	7	46.7
History of exercise	Regular	9	60	5	33.3
	Irregular	6	40	10	66.7
History of wearing footwear	Yes	2	13.3	3	20
	No	13	86.7	12	80

Note: n-frequency, %-percentage, BMI-Body Mass Index, DM-Diabetes Mellitus, OHA- Oral hypoglycemic agents.

The study adopted two methods to assess the neuropathy level of pain, and the frequency and percentage of the

patients with respect to their level of pain are given in table 2.

Table 2: Distribution the diabetic patients in interventional and routine care groups with respect to pre and post test scores on level of neuropathy pain

Variable	Subcategory	Interventional Group				Routine Care Group			
		Pre-test		Post-test		Pre-test		Post-test	
		n	%	n	%	n	%	n	%
Level of neuropathy pain using modified GNPS	Mild Neuropathy Pain	0	0	15	100	0	0	5	33.3
	Moderate Neuropathy Pain	13	86.6	0	0	11	73.4	10	66.7
	Severe Neuropathy Pain	2	13.4	0	0	4	26.6	0	0
Level of neuropathy pain using monofilament testing	Mild risk	0	0	15	100	0	0	5	33.3
	Moderate risk	15	100	0	0	15	100	10	66.7
	Severe risk	0	0	0	0	0	0	0	0

Note: GNPS-Galer Neuropathy Pain Scale.

The data presented in Table 3 explained the mean pre- and post-test scores with respect to the level of neuropathy pain using two techniques, such as modified GNPS and monofilament testing (SWM-10 gm), among the interventional and routine care groups of diabetic patients. A t test had been done to assess the mean difference with respect to the level of neuropathy pain

among the groups before and after the intervention. It is found that there is a significant mean difference between the pre- and post-test scores for level of pain assessed using modified GNPS in the interventional group and the routine care group. It is also found that there is a significant mean difference in the pre- and post-test scores for level of pain assessed using monofilament testing (SWM-10 gm) in the interventional group.

Table 3: Comparison of pre-test and Post test scores on the Level the of Neuropathy pain.

Groups	Pre-test	Post-test	Paired t-test
Level of neuropathy pain using modified GNPS			
Interventional group	66.53 ± 8.14	35.26 ± 7.21	31.5***
Routine care Group	71.6 ± 4.88	56.93 ± 8.52	7.88***
Level of neuropathy pain using monofilament Testing (SWM-10gm)			
Interventional group	5.4 ± 0.76	2.33 ± 0.91	14.2***
Routine care Group	5 ± 0.80	5.26 ± 2.99	4.11

Note: *** Significant at p <0.001. GNPS-Galer Neuropathy Pain Scale, SWM- Semmes-Weinstein monofilament.

Tables 4 and 5 give the details of factors associated with the pre-test scores on level of neuropathy pain using modified GNPS among diabetic patients in the interventional group and the routine care group, respectively. It is found that there was no significant association between sociodemographic and clinical factors with respect to the pre-test scores on the level of

neuropathy pain using modified GNPS, except regarding age among the interventional group of study participants.

Table 4: Factors associated with the pre-test scores on level of neuropathy pain using modified GNPS among diabetic patients in interventional group

Variables	Subcategory	Mild n	Mild %	Moderate n	Moderate %	Severe n	Severe %	χ2 value and df
Age	41 to 60 years	0	0	9	60	1	6.7	χ2=9.264* df =1
Age	61 to 80 years	0	0	4	26.6	1	6.7	
Gender	Male	0	0	4	26.6	1	6.7	χ2=0.396 df =2
Gender	Female	0	0	9	60	1	6.7	
Education	Primary	0	0	4	26.7	0	0	χ2=9.264 df =6
Education	Secondary	0	0	2	13.3	1	6.7	
Education	Higher	0	0	3	20	1	6.7	
Education	Illiterate	0	0	4	26.6	0	0	
Occupation	Private	0	0	1	6.7	0	0	χ2=9.264 df =6
Occupation	Government	0	0	2	13.3	0	0	
Occupation	Business	0	0	2	13.3	1	6.7	
Occupation	Unemployed	0	0	8	53.4	1	6.7	
BMI	Normal weight	0	0	1	6.7	0	0	χ2=9.264
BMI	Overweight	0	0	11	73.3	2	13.3	df =4
BMI	Obese	0	0	1	6.7	0	0	
DM	Type 1	0	0	0	0	0	0	χ2=0 df =2
DM	Type 2	0	0	13	86.6	2	13.4	
Duration of DM	2-5 years	0	0	1	6.7	0	0	χ2=0.17 df =2
Duration of DM	> 5 years	0	0	12	80	2	13.3	
Treatment for DM	OHA	0	0	2	13.3	0	0	χ2=0.1 df =4
Treatment for DM	Insulin	0	0	0	0	0	0	
Treatment for DM	OHA and insulin	0	0	11	73.3	2	13.3	
Comorbidities	Yes	0	0	3	20	0	0	χ2=0.57 df =2
Comorbidities	No	0	0	10	66.6	2	13.3	
Pain in the legs	Yes	0	0	13	86.6	2	13.3	χ2=0 df =2
Pain in the legs	No	0	0	0	0	0	0	
Duration of pain	6 months to 1 year	0	0	6	40	0	0	χ2=1.23 df =2
Duration of pain	>1 year	0	0	7	46.6	2	13.3	
Sensation of pain	Tingling	0	0	1	6.6	0	0	χ2=1.16 df =4
Sensation of pain	Numbness	0	0	4	26.6	0	0	
Sensation of pain	Burning	0	0	8	53.4	2	13.4	

Variable	Subcategory	Mild n	%	Moderate n	%	Severe n	%	χ2 value and df
Management of leg pain	Topical gel/cream	0	0	4	26.6	1	6.7	χ2=0.35 df =2
	Home remedies	0	0	9	60	1	6.7	
History of exercise	Regular	0	0	9	60	0	0	χ2=3.45 df =2
	Irregular	0	0	4	26.7	2	13.4	
History of wearing footwear	Yes	0	0	1	6.7	1	6.7	χ2=3.81 df =2
	No	0	0	12	80	1	6.7	

Note: n-frequency, %-percentage, BMI-Body Mass Index, DM-Diabetes Mellitus, OHA- Oral hypoglycemic agents. * significant at p vale <0.05.

Table 5: Factors associated with the pre-test scores on level of neuropathy pain using modified GNPS among diabetic patients in routine care group

Variables	Subcategory	Mild n	%	Moderate n	%	Severe n	%	χ2 value and df
Age	21 to 40 years	2	13.4	1	6.7	0	0	χ2=2.72 df =4
	41 to 60 years	1	6.7	6	40	0	0	
	61 to 80 years	2	13.4	3	20	0	0	
Gender	Male	1	6.7	6	40	0	0	χ2=2.13 df =2
	Female	4	26.6	4	26.6	0	0	
Education	Primary	1	6.7	1	6.7	0	0	χ2=2.82 df =6
	Secondary	2	13.4	3	20	0	0	
	Higher	0	0	4	26.6	0	0	
	Illiterate	2	13.4	2	13.4	0	0	
Occupation	Private	1	6.7	3	20	0	0	χ2=2.62 df =4
	Government	0	0	0	0	0	0	
	Business	0	0	3	20	0	0	
	Unemployed	4	26.6	4	26.7	0	0	
BMI	Normal weight	1	6.7	4	26.6	0	0	χ2=1.37 df =4
	Overweight	4	26.6	5	33.4	0	0	
	Obese	0	0	1	6.7	0	0	
DM	Type 1	2	13.3	2	13.3	0	0	χ2=0.66 df =2
	Type 2	3	20	8	23.4	0	0	
Duration of DM	<2 years	0	0	1	6.7	0	0	χ2=1.45 df =4
	2-5 years	3	20	3	20	0	0	
	> 5 years	2	13.3	6	40	0	0	
Treatment for DM	OHA	0	0	5	33.3	0	0	χ2=4.67 df =4
	OHA and insulin	5	33.3	5	33.3	0	0	
	No treatment	0	0	0	0	0	0	

		Mild n	Mild %	Mod n	Mod %	Sev n	Sev %	χ2
Comorbidities	Yes	0	0	10	66.7	0	0	χ2=14.98
	No	5	33.3	0	0	0	0	df =2
Pain in the legs	Yes	5	33.3	10	66.7	0	0	χ2=1.72
	No	0	0	0	0	0	0	df =2
Duration of pain	< 6 months	1	6.7	1	6.7	0	0	χ2=1.36
	6 months to 1 year	1	6.7	6	40	0	0	df =4
	>1 year	1	6.7	3	20	0	0	
Sensation of pain	Tingling	1	6.7	2	13.4	0	0	χ2=0.18
	Numbness	1	6.7	3	20	0	0	df =4
	Burning	3	20	5	33.3	0	0	
Management of leg pain	Topical gel/cream	3	20	5	33.3	0	0	χ2=0.12
	Home remedies	2	13.3	5	33.3	0	0	df =2
History of exercise	Regular	2	13.4	3	20	0	0	χ2=0.13
	Irregular	3	20	7	46.6	0	0	df =2
History of wearing footwear	Yes	1	6.7	2	13.3	0	0	χ2=0
	No	4	26.6	8	53.3	0	0	df =2

Note: n-frequency, %-percentage, BMI-Body Mass Index, DM-Diabetes Mellitus, OHA- Oral hypoglycemic agents. Significance at p<0.05.

Tables 6 and 7 give the details of factors associated with the pre-test scores on level of neuropathy pain using monofilament testing SWM-10gm among diabetic patients in the interventional group and the routine care group, respectively. It was found that there was no significant association between sociodemographic and clinical factors with respect to the pre-test scores on the level of neuropathy pain using monofilament testing.

Table 6: Factors associated with the pre-test scores on level of neuropathy pain using SWM-10gm among diabetic patients in interventional group

Variables	Subcategory	Level of neuropathy pain using monofilament testing						χ2 value and df
		Mild		Moderate		Severe		
		n	%	n	%	n	%	
Age	41 to 60 years	0	0	10	66.7	0	0	χ2=0
	61 to 80 years	0	0	5	33.3	0	0	df =3
Gender	Male	0	0	5	33.3	0	0	χ2=0
	Female	0	0	10	66.7	0	0	df =2
Education	Primary	0	0	4	26.6	0	0	χ2=0
	Secondary	0	0	3	20	0	0	df =6
	Higher	0	0	4	26.6	0	0	
	Illiterate	0	0	4	26.6	0	0	
Occupation	Private	0	0	1	6.7	0	0	χ2=0
	Government	0	0	2	13.3	0	0	df =6
	Business	0	0	3	20	0	0	

Variable	Subcategory	Mild n	Mild %	Moderate n	Moderate %	Severe n	Severe %	χ2 and df
	Unemployed	0	0	9	60	0	0	
BMI	Normal weight	0	0	1	6.7	0	0	χ2=0
	Overweight	0	0	13	86.6	0	0	df=6
	Obese	0	0	1	6.7	0	0	
DM	Type 1	0	0	0	0	0	0	χ2=0
	Type 2	0	0	15	100	0	0	df=2
Duration of DM	2-5 years	0	0	1	6.7	0	0	χ2=0
	>5 years	0	0	14	93.3	0	0	df=2
Treatment for DM	OHA	0	0	2	13.3	0	0	χ2=0
	OHA and insulin	0	0	13	86.7	0	0	df=2
Comorbidities	Yes	0	0	3	20	0	0	χ2=0
	No	0	0	12	80	0	0	df=2
Pain in the legs	Yes	0	0	15	100	0	0	χ2=0
	No	0	0	0	0	0	0	df=2
Duration of pain	6 months to 1 year	0	0	6	40	0	0	χ2=0
	>1 year	0	0	9	60	0	0	df=2
Sensation of pain	Tingling	0	0	1	6.7	0	0	χ2=0
	Numbness	0	0	3	20	0	0	
	Burning	0	0	11	73.4	0	0	df=4
Management of leg pain	Topical gel/cream	0	0	5	33.3	0	0	χ2=0
	Home remedies	0	0	10	66.7	0	0	df=2
History of exercise	Regular	0	0	9	60	0	0	χ2=0
	Irregular	0	0	6	40	0	0	df=2
History of wearing footwear	Yes	0	0	2	13.3	0	0	χ2=0
	No	0	0	13	86.6	0	0	df=2

Note: n-frequency, %-percentage, BMI-Body Mass Index, DM-Diabetes Mellitus, OHA- Oral hypoglycemic agents, SWM- Semmes-Weinstein monofilament. Significance at p<0.05.

Table 7: Factors associated with the pre-test scores on level of neuropathy pain using SWM-10gm among diabetic patients in routine care group

Variables	Subcategory	Mild n	Mild %	Moderate n	Moderate %	Severe n	Severe %	χ2 value and df
Age	21 to 40 years	2	13.4	1	6.7	0	0	χ2=2.72
	41 to 60 years	1	6.7	6	40	0	0	df=4
	61 to 80 years	2	13.4	3	20	0	0	
Gender	Male	1	6.7	6	40	0	0	χ2=2.13
	Female	4	26.6	4	26.6	0	0	df=2

Variable	Category	n	%	n	%	n	%	χ²
Education	Primary	1	6.7	1	6.7	0	0	χ2=2.82
	Secondary	2	13.4	3	20	0	0	df =6
	Higher	0	0	4	26.6	0	0	
	Illiterate	2	13.4	2	13.4	0	0	
Occupation	Private	1	6.7	3	20	0	0	χ2=2.62
	Government	0	0	0	0	0	0	df =4
	Business	0	0	3	20	0	0	
	Unemployed	4	26.6	4	26.7	0	0	
BMI	Normal weight	1	6.7	4	26.6	0	0	χ2=2.13
	Overweight	4	26.6	5	33.4	0	0	df =4
	Obese	0	0	1	6.7	0	0	
DM	Type 1	1	6.7	3	20	0	0	χ2=0.45
	Type 2	4	26.6	7	46.6	0	0	df =2
Duration of DM	2-5 years	1	6.7	5	33.4	0	0	χ2=0
	> 5 years	4	26.6	5	33.4	0	0	df =2
Treatment for DM	OHA	0	0	5	33.4	0	0	χ2=3.72
	OHA and insulin	5	33.3	5	33.4	0	0	df =2
Comorbidities	Yes	2	13.3	7	46.7	0	0	χ2=1.24
	No	3	20	3	20	0	0	df =2
Pain in the legs	Yes	5	33.4	10	66.6	0	0	χ2=0
	No	0	0	0	0	0	0	df =2
Duration of pain	< 6 months	0	0	2	13.4	0	0	χ2=1.18
	6 months to 1 year	3	20	4	26.6	0	0	df =4
	>1 year	2	13.3	4	26.6	0	0	
Sensation of pain	Tingling	1	6.7	2	13.3	0	0	χ2=2.99
	Numbness	0	0	4	26.7	0	0	df =4
	Burning	4	26.6	4	26.7	0	0	
Management of leg pain	Topical gel/cream	2	13.4	6	40	0	0	χ2=0.52
	Home remedies	3	20	4	26.6	0	0	df =2
History of exercise	Regular	2	13.4	3	20	0	0	χ2=0.13
	Irregular	3	20	7	46.6	0	0	df =2
History of wearing footwear	Yes	1	6.7	2	13.4	0	0	χ2=0.13
	No	4	26.6	8	53.3	0	0	df =2

Note: n-frequency, %-percentage, BMI-Body Mass Index, DM-Diabetes Mellitus, OHA- Oral hypoglycemic agents, SWM- Semmes-Weinstein monofilament. Significance at p<0.05.

DISCUSSION

This study was conducted to evaluate the effectiveness of bundles of nursing care on the level of neuropathy pain among diabetic patients. In this study, the majority of the study participants belonged to the age group of 41 to 60 years and were overweight. These findings were supported by a study on the effect of contrast bath therapy on superficial peroneal nerve function in diabetic neuropathy patients, in which the mean age was 55.96 ± 8.39 years and most of the participants weight ranged from 56 to 75 kg [16]. From the study, it was also found that, in both the interventional and routine care groups, there were participants who were illiterate and unemployed. Similar findings can be seen from a study conducted to understand the impact of diabetes on work and productivity. Many people reported that the complications of diabetes limited their ability to work [17]. Illiteracy affected the public's awareness of diabetes, its complications, and its management. It also determined the frequency of self-care and accessing healthcare services [18].

Among the study participants, many had suffered from diabetes for more than 5 years in the interventional group, followed by the routine care group. More participants were under treatment for DM with both insulin and oral hypoglycemic agents in the intervention group compared to the routine care group. Among the routine care groups, many had comorbidities compared to the intervention group. Similar findings were seen in a study on the epidemiology of diabetic neuropathy, which found that the neuropathy is mainly seen in patients suffering from diabetes for more than 5 years. It was also seen that the comorbidities and complications were high when there was inadequate treatment for the diabetic patients [19].

Regarding pain, all the study participants had pain in the legs in both the interventional and routine care groups. Among study participants, most of the participants had pain for more than one year in the intervention group and 6 months to one year for routine care group participants. In both groups, burning sensation was the most frequently found clinical symptom, followed by numbness and tingling. Most of the participants in both groups were using home remedies followed by topical gel or cream to manage these symptoms. Similar findings are seen in a study on the challenges of neuropathic pain: the burning pain has been seen as more common, followed by other symptoms like numbness, tingling, aching pain, hyposensitivity, and tightness. It was also seen that mainly topical agents are used to manage these symptoms [20].

In the aspect of exercise, more than half of the participants in the intervention group were doing regular exercise compared to the participants in the routine care group, where most of them were not following regular exercise. Regarding the use of footwear, most of the study participants had no history of wearing footwear regularly, and a few study participants were using microcellular rubber (MCR) in the interventional group. A similar supportive study conducted on an overview of exercise and neuropathic pain found that a combination of aerobic and resistance exercise training can reduce the neuropathic [21]. It is also found that patients may not wear footwear due to ulcers or other deformities. However, it is recommended to wear proper footwear to reduce the risk of injury and further ulcer formation [22].

The study found that there was no significant association between sociodemographic and clinical factors with respect to the pre-test scores on the level of neuropathy pain using modified GNPS and monofilament testing, except regarding age among the interventional group of study participants in the case of modified GNPS. On the contrary, a study found an association between sociodemographic factors such as older age, manual occupation, gender, and deprivation as well as clinical

factors like preexisting pain, duration of diabetes, type of diabetes, triglycerides, high-density lipoprotein (HDL) cholesterol, peripheral artery disease, and neuropathy pain in the diabetic patients [23].

The study found that, after the implementation of bundles of nursing care in the intervention group, some were satisfied, and others were highly satisfied with the intervention. It is also found that there was a significant mean difference between the pre- and post-test scores for level of pain assessed using modified GNPS in the interventional group and the routine care group and using monofilament testing (SWM-10 gm) in the interventional group. This was due to the implementation of bundle nursing care, including contrast baths, isometric exercises, and education on foot care for the intervention group. Similar findings were found in a study that focused on the effectiveness of contrast baths on the level of neuropathy pain. It showed that the neuropathy pain can be reduced with the administration of a contrast bath in the experimental group where the patients suffered from DM [24].

Major limitations of the study include the recruitment of only a few participants in the intervention and routine care groups for the study, as well as the difficulty of explaining the pain scale during the study. It is recommended to conduct single-case studies as well as similar studies that can be replicated on a larger sample. The study also highlighted the importance of using bundles of nursing care in the affiliated hospitals and the contrast bath practice in all community settings.
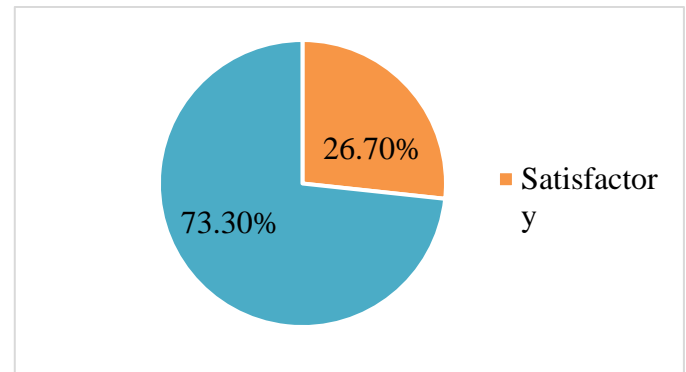
The study revealed that none of the diabetic patients in the interventional group showed any level of unsatisfactory results for the bundles of nursing care. Moreover, about 4 patients showed that the bundles of nursing care were satisfactory, and the majority of the patients (11 patients) showed a high level of satisfaction towards the bundles of nursing care. The percentages of level of satisfaction are given in figure 2.

Figure 2: Level of satisfaction with the bundles of nursing care intervention

CONCLUSION

Diabetic neuropathy most often damages nerves in the legs and feet. Depending on the affected nerves, diabetic neuropathy symptoms can range from pain to numbness in the lower extremities. In cases of prolonged peripheral neuropathy, patients may be vulnerable to injuries or infections, which also affect the person's quality of life. Bundles of nursing care, which include contrast baths, isometric exercise, and foot care management, are effective in the successful management of neuropathy pain.

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