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A Study to Assess the Effectiveness of Aerobic Exercises on the Level of Neuropathic Pain Among the Clients with Diabetes Mellitus Attending the Diabetic Clinics of Selected Hospitals of Bagalkot

Mr. Mallappa R Kamadal[1*], Mr. Prafulla Kumar D[2]

[1]M. Sc. Nursing, Department of Medical Surgical Nursing, B. V. V. S. Sajjalashree Institute of Nursing Sciences Navanagar, Bagalkote
[2]Associate Professor, Department of Medical Surgical Nursing, B. V. V. S. Sajjalashree Institute of Nursing Sciences Navanagar, Bagalkote

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***Corresponding author:** Mr. Mallappa R Kamadal
M. Sc. Nursing, Department of Medical Surgical Nursing, B. V. V. S. Sajjalashree Institute of Nursing Sciences Navanagar, Bagalkote

Abstract **Original Research Article**

Background: Diabetic neuropathy is a common and disabling complication of diabetes mellitus, frequently associated with chronic neuropathic pain that adversely affects quality of life. Pharmacological management often provides incomplete relief and may cause adverse effects, necessitating effective non-pharmacological interventions. Aerobic exercise has been shown to improve glycemic control, enhance peripheral circulation, and reduce pain perception, yet evidence from nursing-led interventional studies in Indian clinical settings remains limited. ***Objective:*** To assess the effectiveness of aerobic exercise on the level of neuropathic pain among clients with diabetes mellitus attending diabetic clinics of selected hospitals in Bagalkot. ***Methods:*** A quasi-experimental pre-test and post-test control group design was adopted. Sixty clients with diabetes mellitus and neuropathic pain were selected using non-probability purposive sampling and allocated into experimental (n = 30) and control (n = 30) groups. Neuropathic pain was assessed using the standardized Leeds Assessment of Neuropathic Symptoms and Signs (LANSS) scale. The experimental group received a structured aerobic exercise program for four weeks, while the control group received routine care. Data were analyzed using descriptive and inferential statistics, including paired and unpaired t-tests and chi-square tests. ***Results:*** In the experimental group, the mean LANSS score significantly decreased from 18.50 ± 3.15 in the pre-test to 15.17 ± 2.74 in the post-test ($t = -7.236$, $p < 0.001$). In contrast, the control group showed no statistically significant reduction in neuropathic pain scores (pre-test: 20.73 ± 2.14; post-test: 20.15 ± 2.14; $p = 0.453$). Significant associations were observed between pre-test neuropathic pain levels and selected sociodemographic variables. ***Conclusion:*** Aerobic exercise was found to be an effective, safe, and feasible nursing intervention for reducing neuropathic pain among clients with diabetes mellitus. Incorporating aerobic exercise into routine diabetic care may enhance pain management and improve patient outcomes.

Keywords: Diabetes Mellitus, Neuropathic Pain, Aerobic Exercise, LANSS Scale, Quasi-Experimental Study.

INTRODUCTION

Diabetes mellitus is a chronic metabolic disorder characterized by persistent hyperglycemia resulting from defects in insulin secretion, insulin action, or both. The global prevalence of diabetes has increased dramatically over recent decades, posing a significant public health challenge. According to the International Diabetes Federation, India accounts for one of the highest numbers of individuals living with diabetes worldwide. Chronic hyperglycemia is associated with long-term damage to multiple organ systems, including the cardiovascular system, kidneys, eyes, and peripheral nerves.

Diabetic neuropathy is one of the most common microvascular complications of diabetes mellitus, affecting nearly half of individuals with long-standing disease. Neuropathic pain associated with diabetic neuropathy is often described as burning, tingling, pricking, or electric shock-like sensations, predominantly affecting the lower extremities. This persistent pain interferes with mobility, sleep, daily activities, and overall quality of life, leading to increased psychological distress and healthcare utilization.

Although pharmacological therapies such as anticonvulsants, antidepressants, and analgesics are commonly used to manage diabetic neuropathic pain,

their effectiveness is often limited and associated with adverse effects. Consequently, there is growing interest in complementary and non-pharmacological approaches to pain management. Aerobic exercise, a cornerstone of diabetes management, has been shown to improve insulin sensitivity, enhance peripheral blood flow, and modulate pain perception through neurophysiological mechanisms.

From a nursing perspective, aerobic exercise represents a cost-effective, safe, and patient-centered intervention that can be easily integrated into routine clinical practice. However, evidence from structured nursing-led interventional studies evaluating the effectiveness of aerobic exercise on neuropathic pain in Indian hospital settings remains scarce. Therefore, the present study was undertaken to assess the effectiveness of aerobic exercise on the level of neuropathic pain among clients with diabetes mellitus attending diabetic clinics of selected hospitals in Bagalkote.

Objectives

- To assess the pre-test level of diabetic neuropathic pain among clients with diabetes mellitus in experimental and control groups.
- To evaluate the effectiveness of aerobic exercise in reducing neuropathic pain among the experimental group.
- To compare pre-test and post-test levels of diabetic neuropathic pain between experimental and control groups.
- To determine the association between pre-test neuropathic pain levels and selected sociodemographic variables.

METHODOLOGY

Study Design: A Quasi-experimental pre-test and post-test control group design was employed to evaluate the effectiveness of aerobic exercise on neuropathic pain among clients with diabetes mellitus.

Study Setting; The study was conducted in diabetic clinics of selected hospitals of Bagalkote, Karnataka, India.

Population; The target population comprised clients with Diabetes mellitus attending the diabetic clinics of selected hospitals of Bagalkote**.**

Sample; The clients with Diabetes mellitus having neuropathic pain and who met the inclusion criteria were selected as sample for the study.

Sample size: A total of 60 participants who met the inclusion criteria.

Sampling Technique: Non-probability purposive sampling technique.

Inclusion Criteria; Clients aged 30–70 years, diagnosed with diabetes mellitus for more than five years, experiencing neuropathic pain, and willing to participate were included.

Exclusion Criteria; Clients with severe foot complications, loss of sensation, or those on pain medications were excluded.

Tool for Data Collection; Neuropathic pain was assessed using the standardized Leeds Assessment of Neuropathic Symptoms and Signs (LANSS) scale. A score ≥12 indicated likely neuropathic pain.

Intervention; The experimental group received a structured aerobic exercise program, including walking-based aerobic activities, administered for two weeks each day for 20 minutes under nursing supervision. The control group received routine care without any structured exercise intervention.

Data Collection Procedure; Baseline assessment (pre-test) was conducted for both groups using the LANSS scale. Post-test assessment was carried out after completion of the two-week intervention.

Data Analysis; Data were analyzed using descriptive statistics (frequency, percentage, mean, standard deviation) and inferential statistics (paired t-test, unpaired t-test, and chi-square test). Statistical significance was set at $p < 0.05$.

RESULTS

PART I: Description of socio-demographic characteristics of sample.

Table 1: Demographic characteristics of study subjects N=60

Socio-demographic characteristics	Control group Frequency	Percentage	Experimental group	Percentage
Age groups				
21-30yrs	4	13.33%	5	16.66%
31-40yrs	4	13.33%	4	13.33%
41-50yrs	7	23.33%	10	33.33%
51-years above	15	50%	11	36.66%
Gender				

Socio-demographic characteristics	Control group Frequency	Percentage	Experimental group	Percentage
Male	18	60%	9	30%
Female	12	40%	21	70%
Educational Status				
No formal education	5	16.66%	3	10%
Primary	15	50%	12	40%
Secondary education	5	16.66%	14	46.66%
PUC/Degree	5	16.66%	1	3.33%
Occupation				
Govt. Employee	9	30%	4	13.33%
Self-Employee	6	20%	5	16.66%
House wife	7	23.33%	12	40%
Agriculture	3	10%	6	20%
Cooli	5	16.66%	03	10%
Area of residence				
Rural	16	53.33%	20	70%
Urban	14	46.66%	10	30%
Family				
Nuclear	29	96.66%	7	23.33%
Joint	1	3.33%	23	76.66%
Duration				
1 to 2 years	1	3.33%	1	3.33%
3 to 4 years	7	23.33%	11	36.66%
4 to 5 years	15	50%	8	26.66%
6 year and above	7	23.33%	10	33.33%
Duration of facing the Neuropathic pain				
1 year	1	3.33%	4	13.33%
2years	17	56.66%	13	43.33%
3years	10	33.33%	10	33.33%
3years above	4	13.33%	3	10%
Presence of any chronic illness.				
Hypertension	24	80%	21	70%
Neurological Disease	3	10%	7	23.33%
Ischemic heart Disease	3	10%	2	6.66%
Others	0	0	0	0%
Patients taking any type of drugs				
Yes	29	96.66%	28	93.33%
No	1	3.33%	2	6.66%
Since from how many years taking drugs				
Less than one year	2	6.66%	3	10%
Two years	23	76.66%	20	66.66%
Three years	4	13.33%	6	20%
More than three years	1	3.33%	1	3.33%
Frequency of Neuropathic pain				
One's a day	0	0	3	30%
Twice a day	30	100%	22	73.33%
One's a weak	0	0	5	16.66%
Twice a week	0	0	0	0%

Part II: Assessment of pre-test Neuropathic pain among the clients with Diabetes mellitus

Section A; assessment of pre-test Neuropathic pain among the client with diabetes mellitus.

Categorization of the clients with diabetes mellitus on the basis of level of knowledge is done as follows, Scores: if score <12, Neuropathic mechanisms are unlikely to be contributing to the patient's pain and if score >12, Neuropathic mechanisms are likely to be contributing to the patients' pain.

Tabel 2: Level of Neuropathic pain among clients with Diabetic mellitus in pre-test

Level of Neuropathic Pain		Experimental Group		Control Group	
	Range of Score	Frequency	Percentage	Frequency	Percentage
Unlikely neuropathic pain	<12	4	13.33%	5	16.66%
Likely neuropathic pain	>12	26	86.66%	25	83.33%

Findings related to assessment of levels of Neuropathic pain among the clients with Diabetes mellitus in Experimental group shows that, highest percentage of (86.66%) of the clients had likely neuropathic pain and (13.33%) of them had unlikely neuropathic pain.

Findings related to assessment of levels of Neuropathic pain among clients with Diabetes mellitus in Control group shows that highest percentage of (83.33%) of the clients had likely neuropathic pain and (16.66%) of them had unlikely neuropathic pain.

Hence the above stated result shows that majority of clients with Diabetes Mellitus of both experimental and control group had high the level of Neuropathic pain.

Section B: Table 3: Mean, SD, and mean percentage of pretest level of neuropathic pain of both Experimental and Control group. N=30+30

Group	Variable	Mean	SD	Mean percentage
Experimental Group	Level of Neuropathic pain	18.5	3.147	66.54%
Control Group	Level of Neuropathic pain	20.13	2.135	69.12%

Findings about the assessment of mean, SD and mean percentage of pretest of Neuropathic pain of clients with diabetes mellitus of experimental group reveals that, the total mean percentage of pretest of Neuropathic pain among clients was 66.54% with mean and SD 18.5 $\pm$ 3.147.

Findings about the assessment of mean, SD and mean percentage of pretest of Neuropathic pain of clients with diabetes mellitus of control group reveals that, the total mean percentage of pre-test of Neuropathic pain among clients was 69.12% with mean and SD 20.13 $\pm$ 2.135.

Hence the above-mentioned results depict that mean percentage of pretest of Neuropathic pain scores of clients of both experimental and control group is almost similar.

Part-III: Evaluation of the effectiveness of the Aerobic exercises programme on Neuropathic pain among clients with Diabetes mellitus.

Table: 4 – Comparison of level of pre-test & post-test neuropathic pain in both experimental & control group

Level of Neuropathic pain	Experimental Group				Control Group			
	Pre test		Post test		Pre test		Post test	
	No. of Respondents	Percentage	No. of Respondents	Percentage	No. of Respondents	Percentage	No. of Respondents	Percentage
Unlikely Neuropathic pain	4	13.33%	19	63.33%	5	16.66	4	13.33%
Likely Neuropathic pain	26	86.66%	11	36.66%	25	83.33	26	86.66%

Findings about the comparison of level of neuropathic pain of clients with Diabetes mellitus among experimental group shows that in pretest 86.66% of clients had likely neuropathic pain and 13.33% had unlikely neuropathic pain. Where as in post-test majority of them 63.33% had unlikely neuropathic pain and 36.66% had likely neuropathic pain.

Where as in the control pre-test group 83.33% of the client where had likely neuropathic pain and 16.66% were had unlikely neuropathic pain. In post-test 13.33%had unlikely neuropathic pain and 86.66% had likely neuropathic pain.

Part IV: Testing of hypothesis

To evaluate the effectiveness of aerobic exercises programme on neuropathic pain among clients with diabetes mellitus a research hypothesis was formulated**.**

H_1: There will be significant difference between the pre-test and post-test level of neuropathic pain among the experimental and control group.

Paired 't' test was used to find out the difference between pre-test and post-test of neuropathic pain of both experimental and control group

Table 5: – Significance of the difference between the pre-test and post-test of Neuropathic pain scores of clients with diabetes mellitus of both experimental and control group

Group	Variables	Mean difference	Differential SD	't' value	P value
Experimental Group	Neuropathic pain	-3.6	2.98	-7.236	0.000***
Control Group	Neuropathic pain	-0.136	0.952	-0.7490	0.453

***P<0.001

Findings related to significance of the difference between pre-test and post test scores of Neuropathic pains of clients with diabetes mellitus on Experimental group shows that, difference between mean pre-test [18.5 $\pm$3.147] and post-test [15.17 $\pm$ 2.735] scores of clients of Experimental group found to be statistically significant at 0.05 level of significance [t= -7.236(p value=0.001, p<0.05]

Findings related to difference between mean pre-test and post test scores of Neuropathic pains of clients with diabetes mellitus of control group shows that difference between mean pre-test [20.13 $\pm$2.135] and post-test [20.15 $\pm$ 2.135] neuropathic pain scores of clients of control group found to be statistically significant at 0.05 level of significance [t-.0.7490(p value=0.453, p<0.05].

Hence as per the above stated findings, it is clear that there was a statistically significant difference between pre-test and post-test Neuropathic pain scores of experimental group and no difference found in control group.

Hence 'H_1' is accepted for Experimental group and rejected for control group.

H_2: There will be significant difference between post-test level of Neuropathic pain among clients with Diabetes mellitus in both Experimental and control group.

Unpaired test 't' was used to find out the significance of difference between post-test level of Neuropathic pain between clients of experimental and control group.

Table 6: Significance of difference between the Post test neuropthic pain scores of clients of experimental and control group

Variables	Group	SD	Mean Diff.	t-value	p-value
Neuropathic pain	Experimental group	3.313	4.567	5.841	0.000
	Control group	2.713			

** *p<0.001

The study results showed that findings related to the significance of the difference between post - test scores of the level of neuropathic pain of experimental and control group subjects revealed that, a statistically significant difference was found between post Neuropathic pain scores of experimental group and control group subjects. [**[t=5.841 (p valve=0.000) p<0.01]**].

Hence H_2 is accepted.

Hence it is concluded that Aerobic exercise programme is an effective tool to decrease Neuropathic pain in clients with Diabetes mellitus.

PART V: - Table 5.19. Association between the pre-test levels of Neuropathic pain among clients with Diabetes mellitus with their selected socio-demographic Variables. N=60

SI NO	socio-demographic variables	Chi-square	P value	Association
1	Age	1.7963	0.182	Not Significant
2	Gender	0.0549	0.8147	Not Significant
3	Education	1.772	0.1831	Not Significant
4	Occupation	1.4423	0.2298	Not Significant
5	Residence	0.8792	0.3484	Not Significant
6	Family	0.0071	0.9328	Not Significant
7	Duration	0.7145	0.7145	Not Significant
8	Facing neuropathic pain	5.5694	0.0183	Significant
9	Any chronic illness	2.5963	0.1071	Not Significant
10	Any drug history	2.4932	0.1143	Not Significant
11	Years of using drug	1.4423	0.2298	Not Significant
12	Frequency of neuropathic pain	8.2051	0.0042	Significant

Findings related to the association between pre-test level of Neuropathic pain among clients with Diabetes mellitus with their selected socio-demographic Variables reveals that, there was significant association

found between neuropathic pain scores of Facing neuropathic pain (X^2 =5.5694) and Frequency of neuropathic pain (X^2 =8.2051). No Significant association found between neuropathic pain and other sociodemographic variable's

Hence H_3 is accepted for only Facing neuropathic pain & Frequency of neuropathic pain and rejected for others.

H3: There will be a significant association between pre-test level of neuropathic pain among the clients with Diabetes mellitus and their selected socio demographic variables.
Hypothesis was tested using chi square test

DISCUSSION

The present study demonstrated that aerobic exercise significantly reduced neuropathic pain among clients with diabetes mellitus. These findings support the growing body of evidence suggesting that regular aerobic exercise plays a vital role in pain modulation and nerve health. Improved peripheral circulation, enhanced glucose utilization, and neurochemical changes may contribute to the observed reduction in neuropathic pain.

The results of this study are consistent with previous studies conducted in both national and international settings, which reported significant reductions in neuropathic pain following structured exercise interventions. From a nursing perspective, the findings emphasize the importance of incorporating aerobic exercise into routine diabetic care as a non-pharmacological pain management strategy.

The absence of significant improvement in the control group further strengthens the evidence that aerobic exercise, rather than routine care alone, contributes to pain reduction. Nurses play a critical role in educating, motivating, and supervising patients to adhere to exercise regimens, thereby enhancing clinical outcomes.

CONCLUSION

Aerobic exercise significantly reduced neuropathic pain among clients with diabetes mellitus, indicating its effectiveness as a non-pharmacological intervention.

Conflict of interest: None

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