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The Effect of Neuropathic Exercise on HbA1c Value in Patients with Type 2 Diabetes Mellitus

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ABSTRACT

Introduction: Complications of diabetic peripheral neuropathy (DPN) are one of the complications of type 2 diabetes mellitus. DPN often occurs in people with diabetes mellitus, where one out of every five people with diabetes mellitus is at risk of it. DPN occurs in more than 50% of people with type 2 diabetes and is a significant risk factor for skin breakdown, amputations, and reduced physical mobility.This study aims to see the effect of neuropathic exercise interventions on decreasing HbA1C values in patients with type 2 diabetes mellitus.

Methods: This research is quantitative research with a Pre-Experimental Design with a Pretest-Posttest Group Design approach aiming to see the effect of neuropathic exerciseon the decrease in HbA1C values in patients with type 2 diabetes mellitus. The intervention carried out in patients with type 2 diabetes mellitus is neuropathic exercise. On*the pre-test,* Patients with type 2 diabetes mellitus were assessed for neuropathy symptoms using 10-gram monofilament and measuring the HbA1C value and then given the intervention of neuropathic exercise, which is carried out every day for 15 minutes for six weeks. On*the post-test,* an assessment of changes in HbA1C values for people with type 2 diabetes mellitus was carried out.

Results: The results showed an effect of neuropathic exercise on a decrease in HbA1C values. Before the intervention of neuropathic exercise, the HbA1C value with a Mean ± SD of 10.42 ± 12.877; after the intervention of the neuropathic e xercise, the HbA1C value became 9.88 ± 2.904 with a *p*value:*0.001.*

Conclusion: Neuropathic exercise can be done in people with diabetes mellitus to decrease HbA1c values and prevent DPN.

Keywords: *Neuropathic Exercise, HbAc1 Value.*

INTRODUCTION

Complications in patients with type 2 diabetes mellitus are on the feet. These complications can cause physical, physiological, and financial problems to them. Complications of diabetic peripheral neuropathy (DPN) are one of the complications of type 2 diabetes mellitus. The prevalence is 13% to 68% in the population with diabetes mellitus[1]

Study group: Their mean age (49.40± 3.35. Neuropathy is a complication that often occurs in people with diabetes mellitus, in which one out of every five people with diabetes mellitus (20%) is at risk of experiencing DPN. Complications of DPN are related to the blood supply to the feet, which occurs due to diabetes mellitus[2]. Patients with type 2 diabetes mellitus complications, in general, have DPN and have the potential to experience

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foot ulceration and infection that can result in amputation of the lower extremities[3].

DPN is heterogeneous, with various clinical manifestations in each patient with diabetes mellitus. DPN occurs in about 75% of people with diabetes mellitus. DPN is defined as a dysfunction of the peripheral nerves affecting the large and small afferent nerves. Usually, people with diabetes mellitus who experience DPN will feel burning pain, feel like they are being stabbed, paresthesia, hyperesthesia, and sometimes may experience numbness[4]. It is a condition with a loss of sensory function in the distal areas of the lower extremities, occurring in 50% of people with diabetes mellitus[5].

Exercise and training can improve neuromuscular strength and treat DPN, such as nerve conduction velocity, pain, and balance[6]. It is one of the most common complications in people with diabetes mellitus (DM). Manual exercise and exercise are very beneficial for people with diabetes mellitus with DPN[7].

The most common complication in type 2 diabetes mellitus is DPN. Training or physical exercise is a way to prevent and treat DPN in patients with type 2 diabetes mellitus. Training or physical exercise has a positive effect on improving foot sensation in patients related[8]. Diabetic peripheral neuropathy (DPN) occurs in more than 50% of people with type 2 diabetes and is a significant risk factor for skin breakdown, amputations, and reduced physical mobility. Regular exercise and exercise are very beneficial for people with diabetes in overcoming DPN[9].

METHOD

This research wasquantitative research where the research design was a Pre-Experimental Design with a Pretest-Posttest Group Design approach aiming to see the effect of neuropathic exercise on decreasing HbA1C values and increasing value by adding 10 Gram Monofilament in patients with type 2 diabetes mellitus. The intervention carried out in patients with type 2 diabetes mellitus is neuropathic exercise. On*the pre-test, the* HbA1C values of the Type 2 diabetes mellitus patients were measured and then given the intervention of neuropathic exercise, which was carried out every day for 15 minutes within six weeks. On *post-test,* the changes in HbA1C values of people with type 2 diabetes mellitus were assessed.The sample in this study were DM patients treated at the Curup Regional General Hospital Polyclinic, Rejang Lebong Regency, Bengkulu Province, Indonesia. The sampling technique used in this study was *probability sampling* or *randomized sampling*. The sample size was at least 35 respondents .Instruments In this study, the intervention carried out was a neuropathic exercise. Patients with type 2 diabetes mellitus did daily neuropathic exercises for 15 minutes within six weeks. Then the HbA1C value was measured. Data Analysis make use of IBM SPSS Version 23 was utilized to analyze the data. The data analysis included respondent characteristics, data normality tests, and mean differencesHbA1c values before and after neuropathic exercise in patients with Type 2 diabetes mellitus.

RESULT

The study was conducted on 35 types 2 diabetes mellitus patients who received therapy at the Curup General Hospital Polyclinic, Rejang Lebong Regency, Bengkulu Province, Indonesia. The characteristics of the respondents can be seen in the following table:

Table 5.1 shows the characteristics of the respondents. The age characteristics indicate that most of the participants aged more than 57 years were 18 (57.1%). Most of the gender was male, with 20 (56.7%) respondents. Meanwhile, in the educational background, respondents from middle to high school were 26(74.3%). Regarding job characteristics, most respondents had a history of not working 26(74.3%). In the duration of suffering from diabetes mellitus, some respondents had had the therapy for

more than five years, amounting to 19(63.3%). In contrast, the treatment carried out by most of the respondents, 28(80%), was insulin.

Table 1. Characteristics of Respondents

Characteristics of Respondents	n	%
Age (years):		
≤ 57	17	48,6
> 57 and above	18	51,4
Average (SD)	9.027	
Gender:		
Man	20	57,1
Woman	15	42,9
Education:		
Middle and High School	26	74,3
University	9	25,7
Work:		
Work	9	25,7
Not working	26	74,3
Diabetes Mellitus Duration		
≤ 5 Years	7	20
> 5 Years	28	80
Treatment Used		
Insulin	7	20
Oral medication	28	80

2. Data normality test results on the effect of neuropathic exercise on HbA1c values in patients with type 2 diabetes mellitus.

Before determining the statistical test, a data normality test was first carried out to see the normality distribution of the data on the effect of neuropathic exercise on HbA1c values in patients with type 2 diabetes mellitus at Rejang Lebong District Hospital, Bengkulu Province, Indonesia. The distribution can be seen in the following table:

Table 2 shows the results of the data normality test using the Shpiro-Wilk statistical test. The normality test results indicated that the p-value was mainly less than 0.05. These results concluded that the data were not normally distributed, so using Wilcoxon as non-parametric statistics was the appropriate statistical test to run.

3. Average difference of HbA1c values before and after neuropathic exercise in patients with type 2 diabetes mellitus.

The statistical test non-parametric Wilcoxon examined the average of HbA1c valuesbefore and after neuropathic exerciseas the result of the abnormality of the data distribution.

Table 2. Data normality test results on the effect of neuropathic exercise on HbA1c values and addition 10-gram monofilament test scores in patients with type 2 diabetes mellitus.

No	Data	Mean	SD	p-value	95%CI
1.	Age	57,21	4,525	0,000	55,63-58,78
2.	Gender	1,44	0,504	0,000	1,27-162
3	Education	1,26	0,448	0,000	1,11-1,42
4	Work	1,26	0,448	0,000	1,11-1,42
5	Lama Diabetes Mellitus	7,00	1,518	0,000	6,47-7,53
6	HbA1c value Before Neuropathic Exercise	10,42	12,877	0,000	8,86-10,89
7	HbA1c value After Nesuropathic Exercise	9,88	2,904	2,904	5,93-14,91

Table 3 Average difference of HbA1c value before and after neuropathic exercise in patients with type 2 diabetes mellitus.

Measurement	Mean	SD	WITH	p	Minimum-Maximum
HbA1c score					
– Before	10,42	12,877	-4,422	0,000	8,86-10,89
– Neuropathy Exercise	9,88	2,904			5,93-6,96
– After Neuropathy Exercise					

Table 3 shows the statistical test results on the difference in the average HbA1c valuesbefore and after neuropathic exercise in patients with DM undergoing therapy at the internal medicine polyclinic at Curup Hospital.As shown in Table 3, the z-value was -4.422, and the p-value was <0.05. These results interpret the significant difference in the average HbA1c valuebefore and after neuropathic exercise in patients with type 2 diabetes mellitus.

DISCUSSION

Effect of Neuropathic Exercise on HbA1c Value

Long-term variations in glycemic values and HbA1c values are a sign of macrovascular and microvascular complications of diabetes mellitus. The average HbA1c value influences the occurrence of complications of DPN[10.] Variations in HbA1c values are associated with cardiovascular and microvascular disease risk in patients with type 2 diabetes mellitus11. Aerobic exercise that is carried out routinely using short exercises can be an intervention to improve peripheral nerve function in patients with type 2 diabetes mellitus[12]. Aerobic exercise can reduce pain in people with DM who experience complications of DPN13. The HbA1c value is a biomarker in diagnosing DM and is associated with DPN complications[14] lower-extremity amputation and mortality. Patients with diabetes mellitus have a predisposition toward developing chronic inflammatory demyelinating polyneuropathy, and this may also facilitate the formation of diabetic foot and cutaneous impairment, which are considered one of the most serious impairments of diabetes mellitus, with a prevalence of 4–10% in this population. Biomarkers research provides opportunities for the early diagnosis of these complications for specific treatments useful to prevent amputation and, therefore, physical inability and mental disturbance. The recent literature has suggested that glycemic levels may be a novel factor in the pathogenesis of diabetic foot complications and is an important mediator of axonal dysfunction. The aim of this systematic literary review is to determine whether hemoglobin A1c (HbA1c. There is an effect of the decrease in HbA1c value and decreased pulse after exercise in patients with type 2 diabetes mellitus[15]. Exercising for more than 150 minutes per week can lower the HbA1c values. Activities carried out at high intensity can reduce the value of HbA1c when compared to activities with low intensity in patients with type 2 diabetes mellitus.Physical activity can help people with diabetes improve cardiorespiratory fitness, increase strength, improve glycemic control, reduce insulin resistance, improve lipid profiles, reduce blood pressure and maintain weight loss[16].

Long-term exercise and training programs have been shown to help people with type 2 diabetes mellitus control blood sugar and significantly affect HbA1C and Basal Metabolic Rate (BMR)[17]. Exercise and training influencethe decrease of HbA1C, Basal Metabolic Rate (BMR), and fasting blood sugar[18]body mass index (BMI.Regular exercise can improve blood sugar control, decrease HbA1C, reduce insulin resistance and increase muscle strength in patients with type 2 diabetes mellitus. Exercise also increases muscle mass and bone density, affecting the functional improvement of the extremities and preventing osteoporosis[19]. Structured exercise and training, such as aerobics for more than 150 minutes per week, can reduce HbA1C in type 2 diabetes patients and should be combined with a diet program[20]. Exercise is beneficial for reducing DPN complications. An appropriate exercise program can be an alternative treatment for DM patients who suffer from DPN[21].Some possible limitations that may negatively impact the validity of the generalization of the research results are that respondents were from one hospital only in Indonesia. Even though the validity and reliability have been tested rigorously, verifying the validity and reliability in other studies with various hospitals is recommended.

CONCLUSION

This study shows that there is an effect of neuropathic exercise on decreasing HbA1c values and an effect of neuropathic exercise on increasing the value of Monofilament 10 Gr. Neuropathic exercise can be recommended to patients with diabetes mellitus to decrease HbA1c values and prevent DPN.

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Conflicts of interest

The authors declare that they have no conflict of interest

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Ethical Considerations

This research was carried out by considering ethical principles during the research process. This research passed the ethical test and obtained the Ethical Permit Number No.KEPK/425/10/2022by the Research Ethics Commission of the Health Engineering Polytechnic of the Bengkulu Ministry of Health. Participants who met the requirements in this study explained the research implementation process and stated that they were willing to become research participants in a written statement. Participants filled in the informant consent that participants understood the information that had been provided. Participants had the right to withdraw from the research without coercion.

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