

## **The Effects of Progressive Muscle Relaxation in Reducing Neuropathic Pain in Type 2 Diabetes Patients**

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### **ABSTRACT**

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Neuropathic pain in DM sufferers can be reduced by providing non-pharmacological therapy by providing relaxation or by providing education such as providing music therapy, relaxation and guided imagery. Physical exercise with relaxation that can be applied to DM patients includes Progressive Muscle Relaxation. The movements in PMR exercises aim to tighten and relax the muscles in one part of the body at a time to provide a feeling of physical relaxation. Relaxation can calm the nervous system so that the sufferer's body relaxes. This study aims to determine the effect of PMR in reducing neuropathic pain in patients with type 2 diabetes mellitus. The research design used the Quasy Experiment One Group Pretest – Posttest Control Group Design. The population in this study were all type 2 DM patients who experienced neuropathic pain. The sampling technique used was purposive sampling. Progressive Muscle Relaxation was given once a day for 7 days, and the pain scale was measured using the Visual Analog Scale (VAS) before and after administering PMR. The results of the study showed that the average pain level in the pre-test control group was 6 and post-test 5, while in the intervention group the average pre-test was 6 and post-test 4.81. The results of the Wilcoxon test in the control group showed a p value of 0.187 so there was no change in pain levels in the control group, while the intervention group showed a p value of 0.0001. The conclusion of this study is that there is a change in pain levels before and after PMR, so PMR can reduce neuropathic pain in patients with type 2 diabetes mellitus.

**Keywords:** Diabetes Mellitus, Neuropathic Pain, Relaxation Muscle Progressive

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## **1. INTRODUCTION**

Diabetes mellitus (DM) is currently a global health threat, worldwide almost half a billion people live with diabetes. Based on data from the International Diabetes Federation, it is estimated that 537 million people suffer from diabetes, and this number is projected to reach 643 million in 2030, and 783 million in 2045. Additionally, 541 million people are estimated to have impaired glucose tolerance in 2021, it is estimated also more than 6.7 million people aged 20–79 will die from diabetes-related causes in 2021 [1].

The results of the 2018 Basic Health Research show that the prevalence of DM in Indonesia based on a doctor's diagnosis at age > 15 years is 2%. This figure shows an increase compared to the prevalence of DM in 2013 of 1.5%. The prevalence of DM according to blood sugar examination results increased from 6.9% in 2013 to 8.5% in 2018. This figure shows that only around 25% of DM sufferers know that they suffering from DM [2].

DM is a complex chronic disease requiring ongoing medical care with multifactorial risk reduction strategies beyond control glycemic [3]. Diabetes mellitus is known as a silent killer because people with diabetes mellitus are not aware of it and when it is known, it is already known happen complications [4]. Complications consequence DM disease can include disorders of the blood vessels, both macrovascular and microvascular, as well as disorders of the nervous system or neuropathy. This disorder can occur in type 2 DM patients who have been suffering from the disease for a long time or who are new to type 2 DM diagnosed [5].

Type 2 DM is a major cause of morbidity and mortality worldwide, due to its high symptom burden and long-term complications. Patients with type 2 diabetes, especially those with poor glycemic control, are at high risk of complications, including coronary heart disease, retinopathy, nephropathy, and peripheral Neuropathy [6]. Diabetic peripheral neuropathy (DPN) is one of the most common microvascular complications and affects almost 50% of patients [7]. DPN causes many debilitating symptoms, such as paresthesia, dysesthesia, decreased sensation, motor weakness, and neuropathic pain, especially in the upper and lower extremities (Ang et al., 2018). Diabetic peripheral neuropathic pain (DPNP) is perhaps the most debilitating symptom of DPN and is commonly described by patients as burning, electric shocks, shooting pain, or non-existent tingling and numbness. comfortable [8].

Nurses are one of the health workers who have an important role in reducing neuropathic pain in DM patients. To reduce neuropathic pain and avoid further complications, efforts need to be made for DM sufferers by providing therapy. Reducing neuropathic pain in DM sufferers with non-pharmacological therapy can be through relaxation or education such as providing music therapy, relaxation and guided imagery [9]. Patient with Neuropathic pain tends to use complementary and integrative therapies such as acupuncture, massage, and some mind body interventions hypnosis, relaxation techniques, and meditation, to reduce the severity of pain and improve well-being them [10]. Physical exercise with relaxation that can be applied to DM patients includes Progressive Muscle Relaxation [11]. The movements in PMR exercises aim to tighten and relax the muscles in one part of the body at a time to provide a feeling of relaxation in a way physical [8]. Relaxation can calm the nervous system, thereby calming the sufferer's body become relax [12]. PMR training has the advantages of not requiring expensive costs, being easy to do independently and having the advantage of restraining the stress response by trying to relieve muscle tension. in a way aware [13].

This is in accordance with results research [14], Studies examining the effects of progressive muscle relaxation on various chronic pain conditions also demonstrated its beneficial effects in reducing pain severity. The results of research [15], examined relaxation Progressive muscle and mindfulness meditation in the diabetic population focuses primarily on glycemic targets.

Based on this background, the author is interested in conducting research on the effect of progressive muscle relaxation in reducing neuropathic pain in patients with type 2 diabetes mellitus. The researchers hope that the results of this study will provide the latest information regarding the provision of non-pharmacological therapy by providing progressive muscle relaxation in reducing neuropathic pain in patients. type 2 diabetes mellitus, so providing progressive muscle relaxation is one of the recommended actions to reduce neuropathic pain in type 2 diabetes mellitus patients.

Based on the description above, the research problem can be formulated " Is there an influence of giving progressive muscle relaxation to reduce neuropathic pain in patients with type 2 diabetes mellitus?".

## 2. METHODS

*pre-experimental* research with a *nonrandomized pretest – posttest with design controls groups design* to determine the effect of providing progressive muscle relaxation in reducing neuropathic pain in patients with type 2 diabetes mellitus. The population in this study were elderly people suffering from type 2 diabetes mellitus at Dr Moewardi Hospital, Surakarta. Sampling used purposive sampling technique with a total of 21 people. The research instrument uses VAS (*Visual Analog Scale*). Data analysis used the Willcoxon test.

### 3. RESULTS AND DISCUSSION

The results of this research show several things, including:

#### Respondent Characteristics

Table 1. Characteristics Respondent

Gender	Control		Intervention	
	Frequency	Percent	Frequency	Percent
Man	13	61.9	12	57.1
Woman	8	38.1	9	42.9
Drug Consumption				
Regular	10	47.6	10	47.6
Irregular	11	52.4	11	52.4
Education				
Bachelor	8	38.1	6	28.6
elementary school	1	4.8	3	14.3
SENIOR HIGH SCHOOL	10	47.6	8	38.1
JUNIOR HIGH SCHOOL	2	9.5	4	19.0
Work				
Laborer	5	23.8	5	23.8
Teacher	3	14.3	3	14.3
IRT	2	9.5	2	9.5
Trader	7	33.3	7	33.3
Employee	1	4.8	1	4.8
Farmer	3	14.3	3	14.3
Age	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>Standard Deviation</i>
Control	47	62	54.38	5,220
Intervention	45	62	54.24	5,088
Long Suffering	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>Standard Deviation</i>
Control	2	6	3.52	1,250
Intervention	2	6	4.05	1,396

The characteristics of the respondents showed that the most common gender in the control group was male, 13 people (61.9%) and the intervention group was male, 12 people (57.1%). The characteristics of respondents based on drug consumption were mostly irregular in the control and intervention groups, 11 people (52.4%). The most common characteristics of respondents based on education were high school, in the control group there were 10 people (47.6%) and in the intervention group there were 8 people (38.1%). Based on occupation, the majority of traders in the control and treatment groups were 7 people (33.3%). Based on the most dominant age, the average in the control group was 54.38 years and in the intervention group 54.24 years. Based on the length of suffering, the most dominant was in the control group an average of 3.52 years and in the treatment group an average of 4.05 years.

The research results of Rokhman, Ahsan & Supriati (2018) showed that the majority were female, 13 people (52%) in the control group and 19 people (76%) in the intervention group. The average age of respondents was 58 and 59 years, while the maximum education was high school for 10 people (40%) in the control group and 9 people (36%) in the intervention group. The average duration of suffering was > 5 years in both the control and intervention groups.

Risk factors that influence diabetes mellitus are Age, age is a risk factor for diabetes mellitus. The older the age, the greater the risk of developing it diabetes mellitus will also increase. Based on Rochman, the older the age group the incident occurs DM increases. Elderly people will experience impaired glucose tolerance. Increased blood glucose levels in patients with increasing age due to insulin resistance due to changes in body composition, decreased activity, changes in eating patterns and decline neurohormonal function [17] . Another risk factor that influences diabetes mellitus is gender, the incidence of diabetes mellitus is higher in women compared to men. According to Taylor, it is caused by a decrease in estrogen hormone levels because of menopause. Estrogen basically functions to balances blood sugar levels and increases fat storage, and progesterone which functions to normalize blood sugar levels and helps use fat as energy. normal, there was an increase in respondents who 11 people experienced hyperglycemia (61%). Based on the results of statistical tests, it shows that blood sugar level results before and after Progressive OOT relaxation in the treatment group has a P value = 0.016, a P value <0.05 then the hypothesis it is accepted that progressive muscle relaxation is effective in lowering blood sugar levels in patients. type 2 diabetes mellitus [18].

### Pain Levels Before and After PMR

Table 2. Pain Levels Before and After PMR

Painful	Control		Intervention	
	Pre	Post	Pre	Post
Min	5	4	5	3
Max	8	6	8	6
Mean	6	5	6	4.81
Standard Deviation	0.837	0.707	0.894	0.928

The average pain level in the pre-test control group was 6 and post-test 5, while in the intervention group the average pre-test was 6 and post-test 4.81.

Progressive muscle relaxation as a therapy to control feelings and anxiety , affective and Physiological responses will appear, for example an increase in blood pressure and heart rate. Progressive muscle relaxation can provide double benefits, namely causing more positive individual adaptation in a short time and reduce the anxiety that occurs does not depend on the neutralization process stressor so that it will reduce the pain experienced by DM sufferers [19] .

Based on research conducted by [20] on group treatment given PMR training for 14 days and carried out in the morning and evening with a duration of ±15 minutes and is fixed taking oral anti-hyperglycemia medication, while in the control group it remained taking oral anti-hyperglycemia medication for 14 days as prescribed by the doctor, shows that the average glucose level blood in the treatment group before administration PMR treatment + oral anti-hyperglycemia medication namely 247.29 mg/dL and after treatment PMR + oral anti-hyperglycemia medication is 210.29 mg/dL. Normal sugar levels will facilitate vascularization so that wound repair and oxygen supply to the periphery will be smooth which will have an impact on reducing pain due to neuropathy.

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Table 3. Data Normality Test

	Group	P value
Control	Pre	0.005
	Post	0.007
Intervention	Pre	0.006
	post	0.005

*Shapiro Wilk* test showed that none of the pain level data was normally distributed because the p value was  $<0.05$ , so the bivariate test used the alternative *Wilcoxon test*.

Table 4. Changes pre and post test pain levels

Group	Z	P value
Control	-1,318	0.187
Intervention	-3,524	0.0001

*Wilcoxon* test in the control group showed a *p value* of 0.187 so there was no change in the level of pain in the control group while in the intervention group it showed a *p value* of 0.0001 so there was a change in the level of pain before and after PMR so there was *PMR* in reducing neuropathic pain in patients he b e test m e l i t u s type 2.

PMR is a systematic and deep relaxation technique by repeatedly tensing and relaxing muscles combined with breathing exercises. PMR is a therapy that focuses on maintaining a state of deep relaxation which involves contraction and relaxation of various muscle groups from the feet upwards or from the head downwards. To stretch a muscle progressively, start by tensing the main muscle groups of the body. In this way, you will be aware of where the muscles will be and in this case will increase awareness of the body's muscle response. The feeling of relaxation that is felt can reduce pain [23].

The results of research conducted by Wahyudi & Arlita (2019) in the group Type 2 diabetes mellitus is controlled or not controlled at Pringsewu Regional Hospital, Lampung given PMR therapy for  $\pm 30$  minutes and measure blood sugar levels before and after being given PMR intervention showed that the average blood glucose level at control group before being given PMR 155.61 mg/dL with a standard deviation of 29.114 and after being given PMR 133.69 mg/dL with a standard deviation of 30.546, while the average blood glucose level in the group did not controlled before being given PMR 311.69 mg/dL with a standard deviation of 64.477 and after being given PMR 271.54 mg/dL with standard deviation 60.363. Decreased blood sugar levels will reduce blood density so that vascularization to the periphery becomes smooth and prevents neuropathy and pain.

Research conducted by [22] explains that relaxation is a form of mind-body therapy in management it is based on work sympathetic and parasympathetic nervous systems. *Progressive muscle relaxation* is a procedures to achieve muscle relaxation through two steps, namely by giving tension in a muscle group and stop the voltage then focus attention on that muscle to become relaxed, to feel a relaxed sensation and the tension disappears. The feeling of relaxation that is felt will have an impact on reducing the stressor that is felt so that the pain that is felt Can suppressed [22].

The results of research [23] show influence application *progressive muscle relaxation* (PMR) to reduce blood sugar levels in diabetes mellitus patients type 2 and found in patients with diabetes mellitus type 2 with problems with blood sugar levels. Sample from the five journals there were 114 respondents with the resulting *p-value* = 0.000 ( $\alpha < 0.05$ ). This means there is an influence of *progressive application muscle relaxation* (PMR) to reduce blood sugar levels in diabetes mellitus patients type 2. Blood sugar levels decrease causing blood concentration to become thinner and vascularization becomes smooth and blood pressure becomes normal. Smooth vascularization will help supply oxygen and nutrients to peripheral cells, thereby reducing the risk of neuropathy in DM patients. The pain experienced by DM patients is due to the neuropathy

process. When the neuropathy process can be repaired with good peripheral cell regeneration, the pain will decrease.

This reduction in pain is related to a person's physical and psychological processes, where pain due to neuropathy causes a person to experience mental stress, thoughts and stress, thus affecting the nervous, endocrine and immune systems. Patients with moderate-severe pain show increased stress hormones and decreased immune cells. This system is known as *psychoneuro-immunology* (PNI) which has a reciprocal relationship both anatomical and biochemical. The action of PMR and music makes respondents relax, increases the release of serotonin, dopamine (*opioid properties*) and suppresses the stress hormone (cortisol) so that it can inhibit receptor pain [24].

Relaxation muscle progressive increase circulation blood in the muscles, decreases rate catecholamines with hinder system nerve sympathetic, and activating system nerve parasympathetic, which induces sensation relaxation and calm through all over body [25]. Progressive muscle relaxation also activates the production of endogenous opioids such as *enkephalins, endo-morphine, and B-endorphin*, and reduces pain-related nerve activity in the insula, thereby demonstrating the impact of progressive muscle relaxation on severity. painful neuropathic [26].

relaxation will inhibit stress feedback pathways and relax the patient's body. The parasympathetic system will dominate in a person's relaxed state, where some of the effects are reducing the speed of heart contractions and stimulating the secretion of the hormone insulin. Dominance of the parasympathetic nervous system will stimulate the hypothalamus to reduce *corticotrophin secretion. Releasing hormone* (CRH). A decrease in CRH will affect the adenohypophysis to reduce the secretion of *adenocorticotropic hormone* (ACTH). This situation can inhibit the adrenal cortex from releasing the hormone cortisol. A decrease in the hormone cortisol will inhibit the gluconeogenesis process and increase the use of glucose by cells, so that high blood sugar levels will decrease and return to normal limits [27].

Researchers concluded that *progressive muscle relaxation* (PMR) can provide a feeling of relaxation, normal blood pressure and lower blood glucose which will facilitate vascularization to the periphery which has an impact on the supply of oxygen and nutrients to the periphery which improves so that it can be used as cell regeneration so that pain due to neuropathy will be reduced

#### 4. CONCLUSION

The conclusion of this study shows that the average pain level in the pre-test control group was 6 and post-test 5, while in the intervention group the average pre-test was 6 and post-test 4.81. The results of the *Wilcoxon* test in the control group showed a *p value* of 0.187 so there was no change in the level of pain in the control group while in the intervention group it showed a *p value* of 0.0001 so there was a change in the level of pain before and after PMR so there was *PMR* in reducing neuropathic pain in patients he b e test m e l i t u s type 2.

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