




The Effectiveness of Massage Therapy on Healing of Diabetic Neuropathy in Diabetes Mellitus Patients

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Abstract

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BACKGROUND: Diabetic neuropathy reduces the patient's quality of life and the quality of diabetes management itself and, as a result, worsens the prognosis of other diabetic complications. Various complaints that are often felt by diabetes mellitus (DM) patients due to neuropathy include pain in the legs, numbness, and weakness in the affected leg, paresthesia, or numbness, and the absence of tendon reflexes in the affected leg.

AIM: This study aimed to determine the effectiveness of electric massage therapy on neuropathy healing in DM patients.

METHODS: The pre-test and post-test experimental design without a control group was employed. Patients with neuropathy diabetic were recruited as the subject of the study. The total number of participants in the study was 30 people. All the subjects were assessed for neuropathy using the neuropathy assessment instrument and the monofilament test. The Kolmogorov–Smirnov test was employed to analyze the normality of the data. The Wilcoxon signed-rank test was employed for non-normally distributed data. The study used a 95% confidence interval, and significance was assessed at alpha <0.05.

RESULTS: Mean difference test resulted that the Z value was -4.791; ($p < 0.01$). These results indicate that there was a statistically significant difference in the level of neuropathy before and after the massage therapy intervention.

CONCLUSIONS: Foot massage therapy has a significant effect in reducing the complaints of diabetic peripheral neuropathy (DPN). It is recommended for the DPN patients to conduct foot massage independently regularly as an alternative treatment in-home care treatment.

Introduction

Diabetes mellitus (DM), one of non-communicable diseases, is serious and lifelong condition that impact on the lives of individuals, families, and societies worldwide [1], [2]. It is among the top ten causes of death in adults with an estimated 1.5 million deaths directly caused by DM. In 2019, the global prevalence of DM was 9.3% and estimated will be rising to 10.2% by 2030 and 10.9% by 2045 [1], [2]. In Indonesia, based on the Basic Health Research (*Riskesdas*), 2018 showed that the prevalence of DM based was 2%. Meanwhile, the prevalence of DM in the Central Java was 2.1% [3].

Long-term (chronic) complications of DM develop gradually. The longer people have diabetes, the less controlled blood sugar, and the higher the risk of complications [1], [2], [4], [5]. Diabetic neuropathy (DN) is one of the most prevalent chronic complications of DM and is a serious complication of Type 1 and Type 2 DM [6], [7]. It is usually affecting both sides of the body. The most common symptoms of DN include decreased sensation and numbness (loss of sense of touch), burning sensation in feet, prickling, or aching sensations [6], [7], [8].

The most common type of neuropathy has diabetes peripheral neuropathy (DPN) [9], [10], which mainly affects the lower extremities and is a major cause of morbidity because of its effects leading to the risk of ulcers, amputations, and subsequent disability [8], [11], [12], [13]. DN reduces the patient's quality of life and the quality of diabetes management itself and, as a result, worsens the prognosis of other diabetic complications [6], [10], [12]. Globally, it is estimated that in Type 2 DM patients, the prevalence of DPN ranges from 21.3 to 34.5%, and in Type 1 ranges from 7 to 34.2% [14]. In Indonesia, it is estimated that DPN prevalence was 43% of DM patients [15], [16], it is quite high compare than global data.

Actions are given to DM patients who have DN in clinical services both in inpatient wards and in surgical polyclinics such as controlling blood glucose levels, increasing physical activity, losing weight, or controlling diet [9], [12]. However, foot care measures that have shown signs of neuropathy have not been carried out. The results of research that have been applied to patients with DN, including; foot gymnastics, electrical *transcutaneous* nerve stimulation, electrical percutaneous nerve stimulation, modular

electromagnetic neural stimulation, and massage showed an improvement in DN complaints [13], [17].

In additional, the foot massage using foot reflexology had a beneficial effect on feet impairment of people with Type 2 DM. It can improve balance, range of motion (ROM) in the lower extremities, and sensory stimulation in the lower extremities in diabetic patients with peripheral neuropathy [13]. The previous studies showed that foot massage increases the sensation of stimulation from the bottom of the foot. Foot massage on respondents who have joint disorders can increase delivery mobility [13], [18].

Foot massage therapy in DN patients can overcome ischemic and neuropathy, so it can increase peripheral tissue perfusion by increasing blood circulation to the periphery, transporting oxygen, and nutrients to peripheral areas/distal areas that experience slowed perfusion in DM with neuropathy, massage can affect blood vessels by dilatation of superficial blood vessels and an increase in the rate of blood flow. When massage therapy is applied to areas of the body such as the foot, blood flow will increase to other body organs. This study aimed to determine the effect of electric foot massage therapy on neuropathy healing in DM patients in Magelang city, Central Java, Indonesia.

Methods

Study site and setting

The study was conducted in all primary health centers (*Puskesmas*) in Magelang, Central Java, Indonesia. The pre-test and post-test experimental design without a control group was employed. The population of the study was all the DM patients who participated in the Chronic Disease Management Program (*Prolanis*), one of health service system from Indonesia Social Insurance Administration Organization (*BPJS*). The sample in this study was DM patients who had neuropathy. The sampling technique was purposive sampling with inclusion criteria: Experiencing neuropathy, controlling blood sugar levels with insulin, and never performing electric massage on the extremity area. While, the exclusion criteria were DM patients who had ulcers or gangrene wounds. The total number of participants was 30 people.

Data collection

All the subjects were assessed for neuropathy using the modified Toronto Clinical Neuropathy Score (mTCNS) and monofilament test. The assessment scores were measured using an interval scale; the highest score was 30 while the lowest was 0 (zero).

Before treatment, a medical history was taken about age, duration of DM, and insulin therapy that given and checked for fasting blood sugar levels. After taking the medical history and conducting a neuropathy test, the respondent was given therapy, namely, electric massage in the distal area of the extremity that experiencing neuropathy. The electric massage is a tool for massage with an electric source given to the extremity area by adjusting the pressure of the electric machine from the lowest pressure to the highest pressure. The electric machine automatically provides simultaneous pressure within a period of 15 min. When adjusting the pressure, the response of the respondent was adjusted.

Each participant in this study was treated with electric foot massage therapy for 15 min, twice a week as long as 4 weeks, then we evaluated the healing of neuropathy and the fasting blood sugar levels.

Statistical analysis

The Kolmogorov–Smirnov test was employed to analyze the normality of the data and used the paired t-tests when appropriate to evaluate within-group changes. The Wilcoxon signed-rank test was employed for non-normally distributed data. The study used a 95% confidence interval and significance was assessed at alpha 0.05.

Ethical consideration

The study was approved by the Health Research Ethics Committee *Poltekkes Kemenkes Semarang* (No: 524/EA/KEPK/2021). We conducted the study with the agreement of the respondents. The aims, risks, and benefits of the study were explained to each participant and they were asked to sign a consent form before enrolment in the study. All personal information of the respondents involved in the study has been kept confidential.

Results

Participants' characteristics

A total of 30 participants were recruited. The most of the participants were female (83%), duration of DM ≥ 10 years (87%), fasting blood sugar level were normal (50%), and neuropathy level was moderate (83%) (Table 1).

Neuropathy scores

The study resulted that electric massage therapy can increase the healing of neuropathy diabetic as reported a decrease in the mean score of neuropathy from 14.10 in the pre-test to 6.43 in the post-test (Table 2).

Table 1: Participants' characteristics (n = 30)

Characteristics	f	%
Gender		
Male	5	17
Female	25	83
Duration of DM (year)		
<10	4	13
≥10	26	87
Fasting blood sugar level		
Normal	15	50
High	15	50
Neuropathy level		
Mild	2	7
Moderate	25	83
Severe	3	10

DM: Diabetes mellitus

Statistical analysis

The result of the Kolmogorov–Smirnov test showed that the data were non-normally distributed (Table 3).

Table 2: Participants' neuropathy scores results before and after the foot massage therapy

Variable	Min	Max	Mean	Median	SD
Neuropathy scores					
Pre-test	10	22	14.10	12	3.75
Post-test	0	16	6.43	6	4.2

Since the p-value of the Kolmogorov–Smirnov test was <0.05, then to determine the mean difference between pre- and post-test, we employed Wilcoxon signed-rank test. The result of Wilcoxon showed that there was a significant mean difference between pre- and post-test ($p < 0.001$) (Table 4).

Table 3: The result of the normality data test

Normality test	Kolmogorov–Smirnov ^a			Shapiro–Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pre	0.245	30	0.000	0.846	30	0.001
Post	0.092	30	0.200*	0.960	30	0.301

Fasting blood sugar level

The study resulted that the percentage of participants' blood sugar level category high and normal before treatment were equal (50%). Meanwhile, after the intervention, participants' blood sugar level category normal was 73%.

Table 4: The result of the mean difference between pre- and post-test

Mean difference	n	Mean rank	Sum of ranks	p-value
Post-Pre				
Negative ranks	30 ^a	15.50	465.00	<0.001
Positive ranks	0 ^b	0.00	0.00	
Ties	0 ^c			
Total	30			

Discussion

DN is among the most common of all the long-term complications of DM with significant mortality and morbidity [8], [13], [5], [19], [20]. It is predicted that up to 50% of DM patients affect DN [6], [11], [21]. There are many subgroups of neuropathies, but the

most common form is symmetrical diabetic peripheral neuropathy (DPN), which mainly affects the lower extremities [8], [10], [11]. DM patients with DPN often complain of symptoms such as numbness, tingling, pain, weakness, and instability when walking [6], [8], [9], [10], [12].

Table 5: Participants' blood sugar level results before and after the foot massage therapy

Blood sugar level	Pre-test (n)	%	Post-test (n)	%
High	15	50	8	27
Normal	15	50	22	73

Our study found that foot massage therapy is effective in the healing of DPN in DM patients. There was a decrease in neuropathic scores before and after the intervention (from 14.10 to 6.43). The most of the participants had mild neuropathy (83%). All the respondents experienced a decrease in neuropathic complaints (Table 5).

Massage therapy is one of the non-invasive and non-pharmacological methods that can be chosen when providing nursing care to DM patients with DPN [13], [18], [19], [21], [22]. Foot massage therapy in our study was conducted by applying gentle pressure to the feet, this is expected to increase and facilitate blood flow to body tissues. Good blood flow will support the supply of oxygen and nutrients to nerve cells, so they will work optimally and reduce complaints of DPN [8], [18], [22], [23].

Foot massage therapy can increase peripheral tissue perfusion by increasing blood circulation to the periphery, transporting oxygen and nutrients to peripheral areas/distal areas that experience slowed perfusion in DM with neuropathy, massage can affect blood vessels by dilatation of superficial blood vessels and an increase in the rate of blood flow. When massage applies to areas of the body, it will increase the blood flow to other body organs [8], [13], [22], [23]. The therapy itself can improve the balance of ROM and stimulate lower extremity sensory [24], [25], [26]. This condition would be affected by the contraction of leg muscles and compression of blood vessels [13], [18], [27].

In addition, the development of DPN is influenced by several factors such as duration of diabetes, poor blood sugar level control, and gender [6], [9], [12]. Our study found that the most of the participants have experienced diabetes for more than 10 years (87%) half of them had high blood glucose levels (50%). The duration of diabetes and poor glycemic control was associated with the increased production of glycosylation end products, metabolic derangements, endothelial injury, and oxidative products. In several longitudinal studies showed the role of poor glycemic control and chronic hyperglycemia as the risk factors for DN. Chronic hyperglycemia causes microangiopathy that triggers the onset of neuropathy [10], [12], [5], [28].

Our study also found that 83% of patients with DPN were female. This finding is in line with the previous study that revealed females were higher suffered DPN

than males. However, the onset of neuropathy in males was earlier than in females [14].

Conclusions

Our study revealed that foot massage therapy using electric massage is effective in the healing of DPN. It is recommended for the DPN patients to conduct foot massage independently regularly as an alternative treatment in home care treatment.

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