



Original Research

The Effect of Foot Massage on Decreasing Peripheral Neuropathy Diabetic Complaints in the Patients with Type 2 Diabetes Mellitus

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ABSTRACT

Background: Peripheral neuropathy diabetic is a problem that will be experienced by almost all patients with type 2 diabetes mellitus (T2DM). One of the non-pharmacological therapies that can be done to reduce the complaints of peripheral neuropathy diabetic is foot massage. The purpose of this study was to determine the effect of foot massage on decreasing peripheral neuropathy diabetic complaints.

Method: The research design was a one group pretest-post-test design (foot massage) as the treatment given to the patients with T2DM. The population in this study was the patients with T2DM who had peripheral neuropathy diabetic. Seventy-two participants were involved as the sample of the study selected through simple random sampling. The data was collected using the questionnaire of the Michigan Neuropathy Screening Instrument.

Result: The results were analyzed using the Wilcoxon Sign Rank test with a significance level was set at $\alpha = 0.05$.

Conclusion: The foot massage had a significant effect at reducing the complaints of peripheral neuropathy diabetic in patients with T2DM ($p=0,000 < \alpha 0.05$). The patients with T2DM are expected to practice foot massage independently.

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INTRODUCTION

Diabetes Mellitus (DM) is one of the most feared health issues of the current age. Metabolic and endocrine disorders occur in the pancreas, especially in the beta langerhans cells. This means that the production of the hormone insulin will be disrupted (Achmad Rudijanto, Agus Yuwono, Alwi Shahab, 2015; Azura, 2012). The disruption of the work of insulin causes an increase in the blood sugar level (hyperglycemia) which triggers various complications and even the poor management of DM. This often contributes to disability and even death (Achmad Rudijanto, Agus Yuwono, Alwi Shahab, 2015).

The World Health Association (WHO) predicts an increase in the number of people with DM in Indonesia from 8.4 million in 2000 to around 21.3 million in 2030. This report shows there to be an increase in the number of people with DM by 2-3 times by 2035. In addition, the International Diabetes

Federation (IDF) predicts an increase in the number of people with diabetes in Indonesia from 9.1 million in 2014 to 14.1 million in 2035 (Achmad Rudijanto, Agus Yuwono, Alwi Shahab, 2015). The high incidence of DM shows that it is essential to handle it to prevent new problems occurring in the form of complications in people with DM.

Peripheral diabetic neuropathy is a problem that will be experienced by almost all people with type 2 diabetes mellitus (T2DM). The complaints include cramps, muscle aches, feeling thick and a feeling of burning or coldness in the legs. The peripheral frequency of diabetic neuropathies in T2DM is quite high at 57.81%, most of whom have had T2 DM for more than 10 years (Hutapea, 2016). The complaints of peripheral neuropathy had a prevalence of 7.5% when found in someone newly diagnosed with T2 DM. It would appear that it had an incidence of more than 50% in patients who'd had T2 DM for more than 25

years. It is estimated that 15% of patients with T2 DM will experience foot ulcers during their lifetime, where 70% will be at risk of relapse and where 85% will end with amputation (Dy SM, Bennett WL, Sharma R, Zhang A, Waldfogel JM, Nesbit SA & Chelladurai Y, Feldman D, Wilson LM, 2017; Gilg, 2016).

Amputation is an action that can have a negative impact not only physically but also psychologically and socially. The loss of part of the body means that the people with T2 DM who undergo amputation experience stress and the disruption of their bodily image (Gilg, 2016). Stress that continues directly will be a trigger factor for increased blood sugar levels and this means that the patients are not obedient to the offered treatment (Nursalam, 2016).

The prevention of amputation must begin with the treatment of peripheral neuropathy. The handling of this is a part of the functions and role of the nurses, one of which is being a caregiver for patients with peripheral neuropathy. This is evidenced from their experience in the field. However, nurses usually only pay attention to wound care rather than controlling the factors that slow the wound itself. The wounds will continue to develop until necrotic tissue forms, which must be amputated. The peripheral prevention of diabetic neuropathy versus the incidence of diabetic ulcers requires much lower maintenance costs compared with treatment after the occurrence of diabetic ulcers (Shaw, 2015).

The preventive measures that can be taken to overcome peripheral diabetic neuropathy include foot exercises and pharmacological therapy. The results of a study conducted by Putri (2016) stated that diabetic foot gymnastics did not fully improve peripheral neuropathy in diabetics. Another effort that can be done is by handling pharmacology but pharmacological approaches that are ongoing for a long time will cause side effects (Achmad Rudijanto, Agus Yuwono, Alwi Shahab, 2015). Researchers should thus make an effort to prevent peripheral neuropathy through doing foot massage.

Foot massage is another method that can be chosen when providing nursing care for patients with T2DM with complaints of peripheral neuropathic diabetic. Foot massage is done by giving gentle pressure to the feet which will hopefully increase blood flow so that it can improve blood flow. Good blood flow will support the supply of oxygen and nutrients to the nerve cells so then the nerves will work optimally and reduce the peripheral neuropathic diabetic complaints (Tschakovsky, n.d.). The repair of blood vessels in the form of an increase in the ankle brachial index has also been shown. The results of this study indicate that the better the ABI value, the lower the peripheral degree of diabetic neuropathy experienced by DM patients. The results of the different study conducted by Harnaya (2014) emphasize further the effect of foot massage on lowering the sensation of foot protection and the scores of the type 2 DM patients, which is related to one of the peripheral symptoms of diabetic

neuropathy. This study showed there to be a significant effect of foot massage on sensory and neuropathic protection (Harmaya, 2014).

Related research on the effect of foot massage at reducing the complaints of peripheral neuropathic diabetes has not been widely performed. Diabetic peripheral neuropathy was examined by the researcher more fully and not only with 10g monofilament. The researcher used the Michigan Neuropathy Screening Instrument (MNSI) questionnaire. It contained two parts in the form of the history of the disease with 4 questions and a physical examination. Physical examinations performed included an examination of the muscular damage, sensory damage and motor damage.

Based on these descriptions, it is important that the nurses pay attention to the prevention of peripheral diabetic neuropathies so then complications can be prevented. One of the non-pharmacological nursing interventions that can be done to reduce the peripheral complaints of diabetic neuropathy is foot massage. However, this intervention still needs to be investigated, therefore this study examines peripheral neuropathy more fully and not only with 10g monofilament.

MATERIALS AND METHODS

The research design was a one group pretest-post-test design (foot massage) as the treatment given to the patients. The population in this study was all of the T2 DM patients in PHC 2 North Denpasar. Seventy-two respondents were selected using simple random sampling.

A data collection tool in the form of foot massage protocol was used by adopting the foot massage theory from the journal of Intermountain Health Care (2016). Each participant in this study performed a foot massage twice a week for 4 weeks starting from the lower leg, stroke, down to the bottom of the foot, thumb stroke, to the top of the foot, thumb stroke with a toe stretch and then repeating the lower leg stroke. For each massage, they took approximately 15 minutes. The Michigan Neuropathy Screening Instrument (MNSI) consisted of two parts in the form of a history of the disease with 4 questions and a physical examination. The physical examination included an examination of the muscular damage, sensory damage and motor damage. MNSI was validated and has good internal consistency. The Cronbach's Alpha for this instrument was 0.703. The Wilcoxon Sign Rank Test was used for the analysis of the changes in the dependent variables before and after the exercise. All of the differences with $p < .05$ were accepted as statistically significant (Pallant, 2010).

Approval and permission to conduct the study obtained from the Board for National Unity and from the Peoples' Protection of Bali Province (070/00932/DPMPTSP-B/2018). In addition, permission to conduct the study was obtained from the head of PHC 2 North Denpasar sub-district, Bali.

The participants signed the inform consent form, thus indicating their permission and willingness to participate in the study. The researchers maintained the anonymity and confidentiality regarding the participants' identity and responses. The result findings were presented in aggregate.

Table 1. General characteristics of the respondents (n = 72)

Characteristic of Age	Median (range)
Age (years)	56 (51-68)
Gender (male/female)	27/4
Peripheral Neuropathy	
Pre	14.5 (6-39)
Post	6.5 (0-27)

Table 2. The results of the effect of foot massage on decreasing the peripheral neuropathy diabetic complaints of the patients with T2DM

Wilcoxon Sign Rank Test	Result
Negative Ranks	72
Positive Ranks	0
Ties	0
P value	0,000

RESULT

As shown in Table 1, the average age was 63 years old. In terms of the Peripheral Neuropathic Diabetic level, it changed from moderate Peripheral Neuropathy to mild Peripheral Neuropathy.

Table 2. The results of the effect of foot massage on decreasing the peripheral neuropathy diabetic complaints of the patients with T2DM. Table 2 shows the results of the *Wilcoxon Sign Rank Test* statistical analysis which indicated that for the 72 negative ranks that showed after being given the *foot massage* intervention, the 72 respondents had a decreased complaint of peripheral neuropathy. The results of the positive ranks was 0; this indicates that after being given the foot massage intervention, no respondents experienced an increase in the complaint of peripheral neuropathy. Tie 0 indicates that none of the respondent's scores remained the same before and after the intervention. From the results of the Wilcoxon sign rank test statistical test, $p = 0,000 < \alpha 0.05$ was obtained. This shows that there was a significant effect from *foot massage* on a decrease in peripheral neuropathic diabetic complaints in type 2 DM patients in the North Denpasar Health Center II working area.

The results showed that the distribution of peripheral neuropathic in diabetics before the foot massage in type 2 DM patients in the North Denpasar Health Center II working area had a range of 6-39. The most dominant respondents belonged to mild neuropathy for as many as 36 respondents (50%) and those with severe neuropathies totaled as many as 9 respondents (12.5%)

DISCUSSION

Peripheral diabetic neuropathy is a nervous disorder especially focused in the peripheral area with symptoms such as pain, tingling or a loss of feeling in the hands, arms and legs (Robert, 2009). The peripheral symptoms of diabetic neuropathy can occur in various places in the body but most of the complaints are mostly felt in the legs. Some of the symptoms include pain, a burning sensation in the legs and tingling. These symptoms are in accordance with the examination that was carried out on the respondents using the Michigan Neuropathy Screening Instrument (MNSI) questionnaire.

Moreover, Pharm (2014) stated that as for the factors that affect peripheral neuropathic diabetics, namely age, the aging process will be increasingly visible. Age will affect nerve damage due to DM (Davies, K., Pharm, D., Pharmacy, P. G. Y., & Resident, n.d.). Azura et al. (2012), concluded that there was a positive correlation of age with the incidence of peripheral diabetic neuropathy (Azura, 2012). This prevalence increased with age, from 5.6% in the participants aged less than 40 years up to 51.8% in patients over 60 years.

Hypertension also affects peripheral diabetic neuropathy. According to Pharm (2014), many diagnoses are comparable to peripheral diabetic neuropathy other than diabetes. Hypertension is an important factor to be considered because it is shown to be significantly associated with peripheral diabetic neuropathy (Davies, K., Pharm, D., Pharmacy, P. G. Y., & Resident, n.d.).

According to the Center for Disease Control and the Prevention of Smoking and Health Office (CDC) (2017), smokers have a 30 - 40% risk of developing DM compared to non-smokers. Cigarettes also trigger the release of oxidative stress and they reduce the oxygen intake to the cells which ultimately trigger cell damage and the inflammatory process. This process will accelerate nerve damage due to hyperglycemia in the DM patients.

From the results of the examinations conducted by the researchers, the respondents who have more than 60 years of age experience severe neuropathic complaints. The respondents who have a history of smoking and hypertension also experienced severe neuropathic complaints. One of the peripheral symptoms of diabetic neuropathy is neuropathic pain. This is supported by the research conducted by Putri (2016), which showed that 93.8% of respondents were found to complain of diabetic neuropathic pain (Putri, M. C., Widodo, S., 2013). The results of another study conducted by Hutapea (2016) found that out of 140 DM patients, 83 of them (59.2%) had neuropathies. The symptoms of peripheral diabetic neuropathy that can occur along with the promotion of DM are known as sensory neuropathies (Hutapea, 2016).

The results showed that the frequency distribution of the peripheral neuropathic diabetic complaints after the foot massage in type 2 DM

patients in the Puskesmas II North Denpasar work area with the score neuropathic respondents in the range of 0 - 27. The dominant respondents were those with moderate neuropathies which were as many as 33 respondents (45.8%) and the lowest number of respondents were those with severe neuropathies, totaling 6 respondents (8.3%).

Reducing peripheral neuropathic symptoms can be done by pharmacological or non-pharmacological approaches. In this study non-pharmacological interventions played a role in reducing complaints of peripheral neuropathic diabetic. Besides treatment is a very important part. Peripheral neuropathic diabetic patients need to care for their feet carefully. The nerves to the legs are the longest in the body and they are the ones most often affected. One should avoid risk factors such as smoking and the consumption of alcohol. Various other foot exercises such as acupuncture, foot massage and other therapies can be an alternative in the context of care (Putri, M. C., Widodo, S., 2013).

From the results of the examination carried out, the results showed that there was a decrease in neuropathic scores after being given the intervention. The results of this study indicate that all of the respondents surveyed experienced a decrease in neuropathic complaints. From the data collection, it showed that the decrease in neuropathic complaints was found the most in relation to autonomic nerve damage. In the post-test, the autonomic nerve damage data in the respondents all decreased to a score of 0. The autonomic nerve examination included dry skin, cracked skin and calluses/callus. During the foot massage, they used olive oil. By using the oil, the skin will become moister so then the respondent's skin will not be cracked. The calluses will be moist and loose. The declining complaints of peripheral neuropathic diabetes according to the researchers are effective when paired with foot massage. Gentle pressure during the foot massage can increase blood flow. According to the researchers, the increase in blood flow can be seen from the change in the color of the respondent's feet when the massage changes it from pale to more reddish. The effect of foot massage is not only from the gentle pressure but also from the oil used during the massage.

The decrease was also seen in sensory nerve damage. This result is in line with the research conducted by Harmaya et al (2014) which shows that there is an effect of foot massage on the sensory protection of DM patients (Harmaya, 2014). These results are in accordance with the theoretical massage done by applying gentle pressure to the feet which is expected to increase and improve blood flow. Good blood flow will support the supply of oxygen and nutrients to the nerve cells so then the nerves will work optimally by increasing the work of sensory nerves (Tschakovsky, n.d.).

The results of the study were based on an analysis of the effect of foot massage on decreasing the peripheral neuropathic diabetic complaints in patients with type 2 DM in the North Denpasar

Community Health Center II working area using the Wilcoxon Sign Rank Test statistical test which obtained a result of negative rank 72. This indicates that following the foot massage intervention, 72 patients experienced a decrease in peripheral neuropathic diabetic complaints. While the results of the positive ranks were 0, this indicates that after being given the foot massage intervention, none of the respondents experienced an increase in their complaint of peripheral neuropathic diabetes. This means that after being given the intervention, the results of the Wilcoxon sign rank test statistical test were $p = 0,000 < \alpha 0,05$. This shows that there is a significant effect of foot massage on the decrease in peripheral neuropathic diabetic complaints in patients with type 2 diabetes in the working area of North Denpasar Health Center II.

Foot massage is another method that can be chosen when providing nursing care for patients with type 2 diabetes with complaints of peripheral neuropathy. The foot massage is done by applying gentle pressure to the feet which is expected to increase the blood flow. Good blood flow will support the supply of oxygen and nutrients to the nerve cells so then the nerves will work optimally and reduce the rate of peripheral neuropathic diabetic complaints (Tschakovsky, n.d.).

With foot massage interventions, they are not only effective at reducing the complaints of peripheral neuropathic diabetics but they can also provide a comfortable feeling because the patient's foot massage will make them more comfortable. The effect of this relaxation, according to the researchers, is very important. Some of the respondents said that they felt comfortable when doing the foot massage. This feeling of comfort is good, as the researchers hope to reduce the stress. It is expected that with reduced stress, the DM patients will be more obedient in the management of diabetes in terms of diet, exercise and pharmacological / non-pharmacological therapies.

The repair of the blood vessels is in the form of an increase in the ankle brachial index. The results of this study indicate that the better the ABI value, the lower the peripheral level of diabetic neuropathies experienced by the DM patients. Different research results were found in the study conducted by Harnaya (2014), which further emphasized the effect of foot massage on peripheral diabetic neuropathies. This study showed a significant effect of foot massage on the sensory and neuropathic processes (Harmaya, 2014).

CONCLUSION

From the results of the study, it can be concluded that there was an effect of foot massage on the decrease in peripheral neuropathic diabetic complaints in patients with type 2 diabetes in the working area of North Denpasar Health Center II. The results of the data collection showed that the neuropathic scores of the respondents before being given the foot massage intervention were in the range of 6 - 39. The

respondents with mild neuropathies were as many as 12 responses (50%) and the least with severe neuropathies by 3 respondents (12.5%). After giving the intervention, there was found to be a decrease in the neuropathic output of the respondents. The data showed that the respondents' neuropathic scores after being given intervention were in the range of 0-27. The respondents with moderate neuropathies were as many as 11 respondents (45.8%) and the responders with severe neuropathies were as many as 2 respondents (8.3%).

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