International Journal of Science and Research Archive

eISSN: 2582-8185

Cross Ref DOI: 10.30574/ijsra

Journal homepage: https://ijsra.net/

(RESEARCH ARTICLE)

Check for updates

The effect of diabetic foot exercise and foot massage on monofilament test scores (neuropathy) in patients with diabetes mellitus

Isma Abdul Gani *, Sunarto Kadir, Irwan, Lintje Boekoesoe and Vivien Novarina A Kasim

Postgraduate Program, Universitas Negeri Gorontalo, Indonesia.

International Journal of Science and Research Archive, 2024, 13(02), 893–899

Publication history: Received on 01 October 2024; revised on 11 November 2024; accepted on 13 November 2024

Article DOI: https://doi.org/10.30574/ijsra.2024.13.2.2186

Abstract

The objective of this study is to analyze the effect of diabetic foot exercises and foot massage on patients with diabetes mellitus, with a particular focus on the Dumbo Raya Health Center in Gorontalo City. The study sample consisted of 30 patients with diabetes mellitus at the Dumbo Raya Health Center. Data were collected through observation and treatment and analyzed using univariate and bivariate analysis methods. The results demonstrated that the intervention of foot exercise and foot massage had a significant effect on the monofilament test score in diabetes mellitus patients at the Dumbo Raya Health Center, Gorontalo City. Both types of intervention exhibited a significance value of 0.000, which was smaller than the value of $\alpha = 0.05$. Furthermore, it was observed that there was a discrepancy in monofilament test scores between the foot exercise and foot massage treatments. The results indicated that foot exercise was more effective in improving monofilament test scores compared to foot massage.

Keywords: Diabetes Mellitus; Foot Massage; Neuropathy; Diabetic Foot Exercise; Monofilament Test Score

1. Introduction

Diabetes mellitus (DM), also known as diabetes, is a metabolic disease in which blood sugar levels exceed normal limits over a long period of time. A number of typical symptoms, including frequent urination, increased thirst and hunger accompanies this increase in blood sugar levels. If left untreated, diabetes can result in a multitude of complications. Acute complications include diabetic ketoacidosis and non-ketotic hyperosmolar coma (Kumar et al., 2020).

Indonesia is the seventh country with the highest prevalence of diabetes in the world, with an estimated 10.7% of the population affected. According to data from the Basic Health Research (RISKEDAS) in 2018, the prevalence of diabetes mellitus based on a doctor's diagnosis in the population of all ages by province, Gorontalo, is above the national average of 1.5%. Despite the prevalence of diabetes mellitus, 42.6% of patients engage in physical exercise as a means of managing their condition (Ministry of Health, R.I., 2018).

Long-term diabetes mellitus can result in a number of complications, including damage to various organs, disability, and even death. The most common health complications associated with diabetes mellitus include cardiovascular disease (CVD), nerve damage (neuropathy), kidney damage (nephropathy), lower limb amputation, and eye disease (mainly affecting the retina), which can result in the loss of vision and even blindness. Nevertheless, if proper management of diabetes is achieved, these serious complications can be either delayed or prevented altogether (IDF, 2021).

Nerve damage (neuropathy) is the most frequent complication experienced by individuals with diabetes mellitus. Diabetic neuropathies are a complex group of pathophysiologically heterogeneous disorders that affect both the somatic and autonomic components of the nervous system (Pérez-Panero et al., 2019). Diabetic peripheral neuropathy (DPN) is

* Corresponding author: Isma Abdul Gani

a prevalent chronic complication of diabetes, affecting approximately half of the diabetic population. Of these individuals, 15% develop foot ulcers and 15%-20% experience lower limb amputation. Diabetic peripheral neuropathy (DPN) is defined by a progressive loss of vibration, touch, and proprioceptive sensitivity, which can also result in motor function problems, including foot and ankle stiffness, reduced muscle strength in the ankle muscles, and stiffness and atrophy of the intrinsic muscles of the foot (Gatt et al., 2020).

The most common symptoms reported by patients with diabetic neuropathy are complete or partial loss of sensitivity to touch and temperature. Untreated diabetic neuropathy results in the loss of protective sensation in the lower extremities, which, when coupled with other factors, significantly increases the risk of complications such as foot injury and ulceration, ultimately leading to lower extremity amputation. A previous study reported that diabetic neuropathy has resulted in more than 80% of amputations after foot ulceration. Diabetic foot ulcers, infection, gangrene, and amputation are associated with higher mortality and a poor prognosis. Furthermore, 50% of patients with amputations and foot ulcers die within five years (Graciella & Prabawati, 2020).

Nurses, as health care providers, play an important role in the prevention of diabetic ulcers and the risk of lower limb amputation. A variety of nursing interventions can be implemented, with current practice often involving foot care in the form of diabetic foot exercises. The most commonly recommended exercise for individuals with DM is foot exercise. Foot exercises are a form of physical therapy that aims to improve blood circulation, strengthen small muscles in the lower extremities, prevent deformities in the shape of the feet, control blood sugar levels, and prevent neuropathy in the feet in individuals with diabetes mellitus (Permatasari et al., 2020).

During the performance of leg exercises, the sensitivity of the contracting muscle cells to insulin is enhanced, thereby enabling the high levels of blood glucose in the blood vessels to be utilized by the muscle cells as energy. Additionally, the reduction in blood glucose levels will result in a diminished accumulation of glucose, sorbitol, and fructose within nerve cells. This will result in enhanced circulation and nerve cell function, or an increase in the sensitivity of the foot nerves (Sanjaya et al., 2019).

Previous research on the efficacy of foot exercises in enhancing nerve sensitivity in diabetes mellitus neuropathy was conducted by Sukartini and colleagues (2019). The results of the study, as determined by the Wilcoxon test, indicated a statistically significant effect (p-value = 0.000). Patients with diabetes mellitus who engage in foot exercises will experience a reduction in the peripheral value of sensory neuropathy. This is attributed to the fact that foot movement exercises can enhance nerve myelin and axon function, thereby improving nerve endings' conduction and sensitivity, as detected by a 10 g monofilament.

In addition to foot exercises, nursing interventions that can be employed to enhance foot sensitivity in patients with diabetes mellitus include foot massage. This is in accordance with the findings of Yuwonoet (2016) in Wardani, et al. (2019), which elucidates that the nerve point in patients with type 2 diabetes mellitus is the pancreas point, which is closely related to the hormone insulin, which affects blood sugar (glucose) levels in the body. When the reflection points on the feet, particularly the pancreas points located on the soles of the left and right feet, are emphasized, the inner edge of the nerve receptors will function, resulting in the stimulation of bioelectricity, which will then spread to the brain and the pancreas. This process improves the production of the hormone insulin and balances blood sugar levels in the body.

The efficacy of foot massage in enhancing nerve sensitivity in individuals with diabetes mellitus neuropathy has been previously investigated by Prandini and colleagues (2019). Their findings, as demonstrated by an independent t-test, indicate a statistically significant effect (p-value = 0.01), whereby there was a notable increase in foot sensitivity following the implementation of a nursing intervention involving foot manual massage. This occurs because the provision of stimuli in the form of foot massage can generate action potentials, resulting in depolarization. This, in turn, results in increased Na+/K+ ATPase activity, axonal transport, and improved sensation in the foot area.

Puskesmas Dumbo Raya is one of the primary health facilities in Gorontalo City, providing services to patients with diabetes mellitus through Prolanis activities. The medical record data of Puskesmas Dumbo Raya indicates that the number of patients with diabetes mellitus increased from 52 in 2020 to 100 in 2021 and to 158 in 2022. The data indicates a consistent annual increase in the number of individuals diagnosed with diabetes mellitus.

The researcher is interested in conducting a study with the title "The Effect of Diabetic Foot Exercise and Foot Massage on Monofilament Test Score (Neuropathy) in Patients with Diabetes Mellitus." The objective of this study is to examine the impact of diabetic foot exercise and foot massage on patients with diabetes mellitus, with a particular focus on the Dumbo Raya Health Center in Gorontalo City.

2. Methods

This research is a quantitative study employing a quasi-experimental two-group pre-test and post-test without control group design. The researchers employed two intervention groups, designated as Group A and Group B. Group A received a foot exercise intervention, while Group B received a foot massage intervention. The intervention was conducted on two occasions per week for a period of three weeks. Both groups will be observed before and after the intervention period. The research sample consisted of 30 patients diagnosed with diabetes mellitus, selected using a purposive sampling technique based on predetermined criteria. The data were collected using instruments in the form of surveys, observations, and documentation. The data were subjected to univariate and bivariate analysis.

3. Results

3.1. Univariate Analysis

3.1.1. Monofilament test score in the diabetic foot exercise group

The results of the monofilament test score in the foot exercise group are presented in Table 1. Table 1 reveals that the mean value of the monofilament test before the administration of the foot exercise intervention on the left foot region was 2.87, with a standard deviation (SD) of 0.640. The mean value obtained for the right foot was 3.07, with a standard deviation of 0.704. The mean value of the monofilament test after foot exercise treatment on the left foot was 5.93, with an SD value of 0.884. The mean value obtained on the right foot was 6.13, with an SD of 0.834.

Table 1 Monofilament Test Score in the Diabetic Foot Exercise Group

Variables	Measurements	Mean	SD	Minimum	Maximum
Monofilament Test Score	*Pretest*				
	Left Foot	2.87	0.640	2	4
	Right Foot	3.07	0.704	2	4
	Posttest				
	Left Foot	5.93	0.884	5	7
	Right Foot	6.13	0.834	5	7

Source: Primary data, 2023

3.1.2. Monofilament test score in the foot massage group

The results of the monofilament test score in the foot massage group are presented in Table 2. Table 2 reveals that the mean value of the monofilament test before the administration of foot massage on the left foot area is 3.07, with a standard deviation (SD) of 0.704. The mean value obtained for the right foot was 3.20, with a standard deviation of 0.561. The mean value of the monofilament test after foot massage treatment on the left foot was 5.13, with an SD value of 0.640. The mean value obtained on the right foot was 5.40, with an SD of 0.632.

Table 1 Monofilament Test Score in the Foot Massage Group

Variables	Measurements	Mean	SD	Minimum	Maximum
Monofilament Test Score	*Pretest*				
	Left Foot	3.07	0.704	2	4
	Right Foot	3.20	0.561	2	4
	Posttest				
	Left Foot	5.13	0.640	4	6
	Right Foot	5.40	0.632	4	6

Source: Primary data, 2023

3.2. Bivariate Analysis

3.2.1. Difference in monofilament test scores before and after diabetic foot exercise

The difference in monofilament test scores before and after foot exercises is presented in Table 3. Table 3 indicates that the results of the paired t-test analysis demonstrate a mean difference of -3.067 between the pre- and post-treatment assessments on the left and right legs. The results on the left foot demonstrated a t value of -20.008, while on the right foot, a t value of -16.877 was obtained, with a significance of 0.000 (smaller than $\alpha = 0.05$). These results indicate that there is a significant effect of foot exercise treatment on the monofilament test score on the left and right legs.

Table 3 Difference in Monofilament Test Scores Before and After Foot Exercise Treatment

Pretest and Posttest Measurements	Mean	SD	t	Sig.
Left Foot	-3.067	0.594	-20.008	0.000
Right Foot	-3.067	0.704	-16.877	0.000

Source: Primary data, 2023

3.2.2. Difference in monofilament test scores before and after foot massage

The difference in monofilament test scores before and after foot massage is presented in Table 4. Table 4 presents the results of the paired t-test analysis, which revealed a mean difference of -2.067 for the left foot and -2.200 for the right foot before and after foot massage treatment. The results on the left foot demonstrated a t value of -13.484, while on the right foot, a t value of -15.199 was obtained, with a significance of 0.000 (smaller than $\alpha = 0.05$). These results indicate that there is a statistically significant effect of foot massage treatment on the monofilament test score on the left and right feet.

Table 3 Difference in Monofilament Test Scores Before and After Foot Massage

Pretest and Posttest Measurements	Mean	SD	t	Sig.
Left Foot	-2.067	0.594	-13.484	0.000
Right Foot	-2.200	0.561	-15.199	0.000

Source: Primary data, 2023

3.2.3. Differences in monofilament test scores between foot exercise and foot massage interventions

The difference in monofilament test scores between the foot exercise and foot massage interventions is presented in Table 5. Table 5 indicates that the results of the independent t-test analysis demonstrate a mean difference between the intervention of foot exercises and foot massage on the left and right feet, with a value of 0.800 for the left foot and 0.733 for the right foot. The results on the left foot demonstrated a t value of 2.840, while on the right foot, a t value of 2.714 was obtained, with a significance level of 0.008 for the left foot and 0.011 for the right foot (lower than the $\alpha = 0.05$ threshold). These results indicate that there is a statistically significant difference in the value of the monofilament test between the treatment of foot exercises and foot massage. It can be concluded that foot exercise is more effective than foot massage in improving the monofilament test score.

Table 5 Difference in Monofilament Test Score Between Foot Exercise and Foot Massage Interventions

Measurement of Foot Exercise and Foot Massage	Beda Mean	SD	t	Sig.
Left Foot	0.800	0.282	2.840	0.008
Right Foot	0.733	0.270	2.714	0.011

Source: Primary data, 2023

4. Discussion

4.1. Effect of Diabetic Foot Exercise on Changes in Monofilament Test Score (Neuropathy) in Diabetes Mellitus Patients at Dumbo Raya Health Center, Gorontalo City

The results of the paired t-test analysis indicate a mean difference of -3.067 between the pre- and post-treatment foot exercises on the left and right feet. The results on the left foot demonstrated a t value of -20.008, while on the right foot, a t value of -16.877 was obtained, with a significance of 0.000 (smaller than $\alpha = 0.05$). These results indicate that there is a significant effect of foot exercise treatment on the monofilament test score on the left and right legs.

The findings of this study align with those of Graciella & Prabawati (2020), who employed the Wilcoxon statistical test and observed a 1.43-point decline in the mean score of the Michigan Neuropathy Screening Instrument (MNSI) following the intervention. Furthermore, the researchers recommend that diabetic foot exercises can be an effective program, as they help to reduce the symptoms of peripheral neuropathy. Empirical evidence from Embuai, et al. (2019) also indicates that foot exercises have a profound impact on diabetic neuropathy, with a statistical significance value of 0.000 ($p < 0.05$). As demonstrated by Embuai, et al. (2019), foot exercises represent a viable independent nursing intervention for the prevention of complications associated with diabetes mellitus. This intervention has been shown to improve the peripheral vascular status of individuals with diabetes mellitus by 70-80%.

Hamed (2018) posited that foot exercises exert a beneficial influence on peripheral neuropathy through the mediation of enhanced microvascular functionality and fat oxidation, which is achieved by the reduction of oxidative stress and the augmentation of neurotrophic factors. Furthermore, foot exercises can also enhance peripheral perfusion. Consequently, it can prevent the progression of diabetic neuropathy.

Diabetic foot exercises are designed to enhance blood circulation, reinforce minor muscles, forestall the development of foot deformities, augment the strength of the calf and thigh muscles, and surmount limitations on joint mobility. The sensitivity of contracting muscle cells to insulin will increase, facilitating the utilization of elevated blood glucose levels in blood vessels by muscle cells as an energy source. Furthermore, reduced blood glucose levels will also result in a reduction in the accumulation of glucose, sorbitol, and fructose within nerve cells. This will improve circulation and nerve cell function, or increase the sensitivity of the foot nerves, thereby reducing the risk of or preventing the occurrence of diabetic foot ulcers (Sanjaya, et al., 2019).

4.2. Effect of Diabetic Foot Massage on Changes in Monofilament Test Score (Neuropathy) in Diabetes Mellitus Patients at Dumbo Raya Health Center, Gorontalo City

The results of the paired t-test analysis indicate a mean difference of -2.067 for the left foot and -2.200 for the right foot before and after foot massage treatment. The results on the left foot demonstrated a t value of -13.484, while on the right foot, a t value of -15.199 was obtained, with a significance of 0.000 (smaller than $\alpha = 0.05$). These results indicate that there is a statistically significant effect of foot massage treatment on the monofilament test score on the left and right feet.

The findings of this study are consistent with those of Prandini & Handayani (2019), who demonstrated that foot manual massage had a significant effect on foot sensitivity, with a p-value of 0.001 on the right foot and left foot. Furthermore, the mean difference in foot sensitivity between the intervention group before and after the nursing intervention foot manual massage was 1.06 on the right foot and 0.89 on the left foot. This evidence demonstrates that there is a discernible difference in the average foot sensitivity following a nursing intervention foot manual massage. This increase in average foot sensitivity can be observed in the data. The results of the study were also corroborated by research conducted by Novita, et al. (2023), which demonstrated that regular reflexology of the feet is an effective method for reducing blood sugar levels and enhancing skin sensitivity by increasing blood flow to peripheral nerves. This approach has the potential to prevent complications associated with diabetes mellitus, including diabetic ulcers, as well as other diseases.

The findings of this study align with the hypothesis proposed by Paju et al. (2022), which suggests that diabetic foot massage facilitates the smooth flow of blood, directly affecting the nerves in the feet. This, in turn, reduces the deposition of sugar in the blood and ensures the delivery of oxygen and nutrients to all parts of the body, including the toes. Improved circulation, in turn, contributes to feelings of relaxation and enhanced quality of sleep. This foot massage is also beneficial for all parts of the foot, as it ensures an adequate supply of oxygen, which in turn reduces the occurrence of tingling and numbness, which are common symptoms of diabetic neuropathy.

4.3. Differences in the Effect of Diabetic Foot Exercise and Foot Massage on the Monofilament Test Score (Neuropathy) in Diabetes Mellitus Patients at the Dumbo Raya Health Center, Gorontalo City

The results of the independent t-test analysis indicate a mean difference between the intervention of foot exercises and foot massage on the left and right feet. The mean difference for the left foot is 0.800, while the mean difference for the right foot is 0.733. The results on the left foot demonstrated a t value of 2.840, while on the right foot, a t value of 2.714 was obtained, with a significance level of 0.008 for the left foot and 0.011 for the right foot (lower than the $\alpha = 0.05$ threshold). These results indicate that there is a statistically significant difference in the value of the monofilament test between the treatment of foot exercises and foot massage. It can be concluded that foot exercise is more effective than foot massage in improving the monofilament test score.

The results of this study indicate that there is a difference in the increase in monofilament test scores between foot exercises and foot massage. It can be argued that foot exercises are more effective than foot massage. This is due to the fact that, in addition to enhancing blood circulation to the lower extremities, foot exercises also play a direct role in the prevention of foot ulceration by increasing muscle strength and reducing joint stiffness, thus maintaining and improving the ability to walk. Furthermore, it can maintain homogeneous plantar pressure for a longer period, thereby reducing the risk of ulceration and increasing sensitivity in the foot, which in turn can improve the monofilament test score.

This opinion is consistent with Alfred's research (2020), which indicates that foot exercises are among the most commonly recommended routine exercises due to their beneficial effects on pharmacological and medical treatments, as well as their benefits for macro- and microvascular health. The results of the study indicated that a foot gymnastics exercise program resulted in a significant overall reduction in peak plantar pressure during the gait phase. The greatest reductions were observed in the heel and metatarsal regions ($p < 0.0005$) and in the hallux ($p = 0.012$) in diabetic neuropathic patients with decreased sensitivity of the sole area.

The intervention in the group that received foot massage was designed to improve circulation in the foot area without increasing muscle strength or reducing joint stiffness, as well as to alter the body's metabolism. One of the observed changes was an improvement in pancreatic function. Additionally, the mean score of the monofilament test in the foot massage group was found to be slightly lower than that of the foot exercise group. This conclusion is further supported by the findings of Heidar et al. (2021), which indicate that gymnastic exercises can enhance insulin sensitivity and insulin resistance in diabetic patients. A regular gymnastic exercise program has been demonstrated to be beneficial in improving balance and HbA1c in patients with diabetic neuropathy.

5. Conclusion

The objective of this study is to analyze the impact of diabetic foot exercises and foot massage on patients with diabetes mellitus at the Dumbo Raya Health Center in Gorontalo City. The results of the study indicate that the provision of foot exercise and foot massage interventions has a significant effect on the monofilament test score in patients with diabetes mellitus at the Dumbo Raya Health Center in Gorontalo City. The two types of intervention exhibited a significance value of 0.000, which is less than the value of $\alpha = 0.05$. Furthermore, it was observed that there was a discrepancy in monofilament test scores between foot exercise and foot massage treatments. The results indicated that foot exercise was more effective in improving monofilament test scores compared to foot massage.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

References

[1] Afianti, N., & Mardhiyah, A. 2017. The Effect of Foot Massage on the Quality of Sleep of Patients in the ICU Room. Jurnal Keperawatan Padjadjaran, 5(1)

[2] Budhi Sanjaya, P., Luh Putu Eva Yanti, N., & Mira Puspita, L. 2019. Effect of Diabetic Foot Gymnastics on Foot Sensitivity in Dm Type 2 Patients. In Community of Publishing in Nursing (Vol. 7, Issue 2).

[3] Burgess, Frank, Marshal, et, al. 2021. Early detection of diabetic peripheral neuropathy: A focus on small nerve fibres. Diagnostics 2021, 11, 165. https://doi.org/10.3390/diagnostics11020165

[4] Elyta. 2022. Management of Diabetic Foot Gymnastics on Sugar Levels in Nursing Care for Diabetes Mellitus Patients. Jurnal Sains dan Teknologi. Vol. 1 No. 2 (April 2022) 127-132

[5] Embuai, et al (2019). Effect of Foot Exercise and Care on Peripheral Vascular Status in Patients with Diabetes Melitus. Jurnal Ners Vol. 14, No. 3, Special Issue 2019

[6] Fadlilah, S et al. 2019 Effectiveness Of Diabetic Foot Exercises Using Sponges And Newspapers On Foot Sensitivity In Patients With Diabetes Melitus. Belitung Nursing Journal. 5(6), 234-238

[7] Gatt, A., Hampton, S., & Formosa, C. 2020. The Effect of Exercise on Gait Biomechanics of the Neuropathic Diabetic Foot. https://creativecommons.

[8] Graciella, V., & Prabawati, D. 2020. The Effectiveness of Diabetic Foot Exercise to Peripheral Neuropathy Symptoms and Fasting Blood Glucose in Type 2 Diabetes Patients.

[9] Guyton dan Hall. 2019. Buku Ajar Fisiologi Kedokteran (Edisi 13). Singapura. Elsevier

[10] Hamed, 2018. A review of diabetic peripheral neuropathy management given recent guidelines updates. Arch Gen Intern Med. 2018; 2 (4): 1- 5 Arch Gen Intern Med 2018 Volume 2 Issue, 2018

[11] Heidari, et all. 2021. Integrated exercise and glycemic and peripheral sensation control in diabetic neuropathy: A single-blind, randomized controlled trial. International Journal of Preventive Medicine 2021, 12: 169

[12] Kumar, R., Saha, P., Sahana, S., & Dubey, A. 2020. A Review on Diabetes Melitus: Type1 & Type 2. https://doi.org/10.20959/wjpps202010-17336

[13] Mishra, S. C., Chhatbar, K. C., Kashikar, A., & Mehndiratta, A. 2017. Diabetic foot. BMJ (Clinical Research Ed.), 359, j5064. https://doi.org/10.1136/bmj.j5064

[14] Novita, dkk. 2023Effect of Foot Reflexology on Neuropathy in Patients with Diabetes Mellitus. Balige, JKH Vol.3 No.1 Mei 2023

[15] Paju, et all. 2022. The Effect of Foot Massage on Peripheal Neuropathy in Patientes with Diabetes Melitus: A Systematic review. Malaysian Journal of Medicine and Health Science (e-ISSN:2636- 9346).

[16] Pamungkas dan Usman. 2021. Practical Guide to Diabetes and Neuropathy Risk Screening. Bondowoso; KHD Production.

[17] Pérez-Panero, A. J., Ruiz-Muñoz, M., Cuesta-Vargas, A. I., & Gónzalez-Sánchez, M. 2019. Prevention, assessment, diagnosis and management of diabetic foot based on clinical practice guidelines: A systematic review. Medicine, 98(35), e16877. https://doi.org/10.1097/MD.0000000000016877

[18] Permatasari, K. D., Ratnawati, D., Anggraini, N. V., & Artikel, R. 2020. Effectiveness of Combination Therapy of Foot Gymnastics and Warm Water Soak on Foot Sensitivity in Elderly with Diabetes Mellitus. Universitas Muhamadiyah Tangerang, 5.

[19] Petersmann, et al, 2019. Definition, Classification and Diagnosis of Diabetes Melitus. Experimental and Clinical Endocrinology and Diabetes Exp Clin Endocrinol Diabetes 2019; 127 (Suppl 1): S1–S7

[20] Sukartini, et.al. 2019. The Influence of Diabetic Foot Exercise in Sensory Peripheral Neuropathy with Monofilament Test on Diabetes Melitus Clients. Jurnal Ners Vol. 14, No. 3, Special Issue 2019 http://dx.doi.org/10.20473/jn.v14i3(si).17263