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Foot Exercise with Tennis Ball for Peripheral Neuropathy in Diabetes Mellitus Type-2: A Case Study

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KEYWORDS
diabetes mellitus, type-2 DM, peripheral neuropathy, diabetic foot exercises, tennis ball modified foot exercises, foot care

ABSTRACT
Peripheral neuropathy is one of the long-term microvascular complications that significantly affect individuals with type-2 DM, characterized by nerve damage and loss of sensation. Most individuals with type-2 DM experience peripheral neuropathy as a common complication, which is responsible for a fairly high rate of mortality, illness, and decreased quality of life. Foot exercises using modified tennis balls help alleviate the symptoms of neuropathy in people with type-2 DM. This study aims to apply and evaluate the effectiveness of foot exercises with tennis ball modification in reducing peripheral neuropathy in type-2 DM patients. The case study focuses on adult patients who have been diagnosed with type-2 DM with complications and are currently facing problems in the lower extremities in the form of peripheral neuropathy. The intervention consisted of educating patients about foot care and engaging in foot exercises using a modified tennis ball for 30 minutes daily over a period of 2 weeks. Measurements included foot health checks, monofilament test examinations, and blood sugar checks during diabetic neuropathy, assessed on the first day and then after every 3 foot training sessions. The results showed a decrease in peripheral neuropathy symptoms, lower blood glucose levels, and improved overall foot health. The findings suggest that foot exercises using a modified tennis ball can be an effective and practical approach to managing peripheral neuropathy in type-2 DM patients. This method not only alleviates symptoms but also contributes to better glycemic control and overall foot health, enhancing the quality of life for those affected.

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INTRODUCTION

Type-2 diabetes mellitus is recognized by the World Health Organization (WHO) as a significant global health problem due to its widespread prevalence. WHO data reveals that type-2 diabetes mellitus affects 90-95% of the global diabetic population, making it the most common form of the disease. According to the International Diabetes Federation, the number of people with diabetes worldwide is expected to continue rising (Saeedi et al., 2019). They estimate that by 2021, 537 million people were living with diabetes, accounting for almost 10.5% of the global adult population aged 20-79 years. This number is projected to increase to 783 million by 2045. In 2019, the IDF reported that type-2 DM was responsible for 4.2 million deaths worldwide. The disease has become a leading cause of death in developing countries, including Indonesia, particularly among adults aged 30-69 years (Muharram et

al., 2024). The rising prevalence of type-2 diabetes is alarming due to its association with increased morbidity and mortality in Indonesia, where the current prevalence among adults is around 2.33%.

Given the escalating global prevalence of type-2 diabetes mellitus, understanding the causes, effects, and effective management strategies for this disease is crucial. In Indonesia, the increase in type-2 DM cases is largely attributed to improving economic conditions and lifestyle changes, with type-2 DM now ranking as the third most common cause of death among non-communicable diseases. The prevalence of diabetes mellitus in West Jakarta, for example, is 76.5% at Cengkareng Primary Health Care and 50% at Fatmawati Hospital, indicating that a significant percentage of people in the same area are affected by this condition. In the Semanan I area of West Jakarta, type-2 DM ranks second among non-communicable diseases reported by local health centers (Tarigan, Siagian, Sudaryati, & Lubis, 2023).

Type-2 DM is a chronic metabolic disorder caused by pancreatic dysfunction or genetic factors, resulting in decreased insulin secretion and chronic hyperglycemia (Lima, Moreira, & Sakamoto-Hojo, 2022). This condition can cause significant damage to the heart, kidneys, blood vessels, and nerves. Diabetic peripheral neuropathy is a common complication, manifesting as decreased sensation, abnormal sensation, pain, numbness, or paresthesia, leading to peripheral nerve dysfunction. If untreated, diabetic peripheral neuropathy can result in ulceration, deformity, peripheral ischemia, and increased risk of amputation, significantly reducing the patient's quality of life (Dewi & Hinchliffe, 2020).

Various interventions aim to reduce the occurrence of diabetic peripheral neuropathy through improved glycemic control, rehabilitation programs, controlled exercise, and education. These interventions help mitigate the risk factors associated with neuropathy, including musculoskeletal deficiencies. Secondary strategies, such as foot care practices, play a critical role in managing diabetic peripheral neuropathy (Smith et al., 2022). These include self-care routines, proper footwear selection, physical activities like foot exercises, dietary adjustments, and pharmacological therapies.

Several studies have explored the effectiveness of foot care and physical activities, such as diabetic foot exercises with tennis ball modifications, in addressing diabetic peripheral neuropathy in type-2 DM patients (Mascarenhas et al., 2023). These exercises have been shown to reduce neuropathy symptoms, improve joint mobility and leg muscle function, increase foot sensitivity, alleviate muscle and ligament tension, enhance gait speed, improve static balance, and lower postprandial blood sugar levels. Regular practice, recommended 2-3 times per week for 20-30 minutes per session, can also prevent foot ulceration and deformity. Diabetic foot exercises are particularly beneficial for patients with type-1 and type-2 DM who can walk independently, offering a cost-efficient and convenient way to manage their condition (Carabott, 2023).

Given these issues, this case study aims to apply and evaluate the effectiveness of foot exercises with tennis ball modifications in reducing peripheral neuropathy in type-2 DM patients. The purpose of this research is to provide an in-depth understanding of the impact of these foot exercises on specific individuals, offering insights that may not be achievable through other research methods (Sparkes, 2015). The primary research question is: How effective are foot exercises with tennis ball modifications in reducing peripheral neuropathy in type-2 DM patients? The findings from this study could provide a valuable intervention to help improve the quality of life for patients suffering from this condition.

METHOD

The method used is a case study with a nursing process approach on a total of three patients. This study aims to apply and evaluate the effectiveness of foot exercises with tennis ball modification in

reducing peripheral neuropathy in type-2 DM patients. This case study focuses on adult patients who have been diagnosed with type-2 DM and are currently facing problems in the lower extremities in the form of peripheral neuropathy. The patient's intervention consisted of receiving education about foot care and engaging in foot exercises using a tennis ball modification for 30 minutes every day over a period of 2 weeks 14 times. Interventions are given in the form of booklets, videos, posters, and leaflets. For a period of 2 weeks, families are involved in receiving education and engaging in foot gymnastics activities. Foot exercises using tennis balls are carried out by clients with type-2 DM, clients with diabetic peripheral neuropathy, clients with monofilament test scores > 4 and are able to walk independently while clients who are not allowed to participate in foot exercises with tennis balls are clients who experience mental illness, dementia, anxiety, total amputation, history of surgery on the knee, legs, waist, major vascular complications, rheumatology, ulcers that do not heal within 6 months or active ulceration.

The case study was carried out from August 5 to August 25, 2024, at a family house in Semanan I, West Jakarta Region RW 05. The researcher provides nursing care through the application of foot exercises using a tennis ball, with a frequency of 1 time a day for 30 minutes and 1 repetition. In processing the data, an analysis was carried out to find out if there was a decrease in diabetic peripheral neuropathy points after the application of foot exercises using tennis balls (Eroğlu & Kutlutürkan, 2024a).

The implementation of foot gymnastics using tennis balls is carried out by preparing equipment: tennis balls, chairs, and foot mats. The foot gymnastics movement using a tennis ball consists of the movement of stepping on the ball, positioning the foot on the ball, and moving forward and backward 8 times with the position of the sole of the foot on the ball. Place your feet on the ball with your heels attached to your feet, and do movements to hold the ball with your toes 16x right and left. Put your feet on the ball with your heels on the floor, and do a movement of shaking your feet on the ball right and left as many as 8 times, right and left. Put your feet on the ball with your heels on the floor, make a movement to pass the ball, and use the soles of your feet to the right and left as many as 8 times, right and left. Put your feet on the ball with your heels not attached to the floor, make circular movements in one direction and opposite clockwise 8 times right and left. Put the heel of the foot on the ball and do the instep bending movement inward 8 times right and left. Put the heel of the foot on the ball, do the instep movement, bending outward 8 times on the right and left feet. Clamp the ball with the inside of both feet and do a movement to lift the ball up and down with the heel position attached 8 times. Put the inside of both feet on the ball, and do a back-and-forth movement with the soles of your feet attached to the ball 8 times. Position your feet with your heels attached to each other and place the ball between your feet, do a grasping movement, and release the ball 8 times.

RESULT AND DISCUSSION

History

Adult male and female patients who have been diagnosed with type-2 DM with a blood sugar of 300 g/dl have a history of type-2 DM since 1-5 years ago with complications of kidney failure, retinopathy, cardiovascular disease in the form of cardiomegaly, hypertension and are currently facing problems in the lower extremities in the form of peripheral neuropathy with complaints of numbness in the legs and abnormal sensations measured using foot health screening and monofilament test High risk was obtained (+2) right foot and (+3) left foot with a monofilament test score of > 4. Other problems in the lower extremities in the form of edema in both legs are characterized by CRT > 2 seconds, cold aural, inelastic skin turgor, and weak palpable dorsalis pulse. There is a history of ulcers, ulcers on the soles of the feet, scratches on the feet, and the skin color of the feet tend to be dark blackish "gunpowder"

(Gordon, 2023). Based on the examination and findings, it was found that the client had type-2 diabetes mellitus with complications in decreasing peripheral neuropathy points with a monofilament test score of > 4, in the form of symptoms of numbness and abnormal sensations.

Measurement results

The measurement of the results used consists of:

1. Foot health check-up for people with diabetes mellitus: If the result is positive when there is one or more "YES" answers, refer to a health care facility for prevention, treatment, and follow-up
2. Monofilament test (neuropathy): Neuropathy if more than 4/10 indicates nothing felt "YES" is performed on 9 plantar regions and 1 dorsal leg
3. Current blood sugar check (GDS) with glucometer: if the result > 200 mg/dl, GDS is high (abnormal)

This assessment is given on the first day and then every 3 leg exercise sessions.

Table 1.
Intervention (Standard Operating Procedure for Foot Gymnastics Using a Tennis Ball)

Orientation Phase	Frequency
• Therapeutic greetings (greeting, introducing, conveying goals) • Inform the patient of the place, destination time, and rules for foot exercises with tennis balls • Preparing the equipment (tennis ball, chair, cushion or foot mat) • Prepare the environment (create a safe and comfortable environment for patients	It is carried out every day 1x a day 14 times with a duration of 30 minutes
Working Phase	
1. Instruct the patient to sit in a chair with both feet on the mattress/footrest 2. The first movement of stepping on the ball is to position your feet on the ball, moving forward and backward as many as 8 times with the position of the soles of your feet on the ball 3. Place your feet on the ball with your heels attached to your feet, and do movements to hold the ball with your toes 16x right and left 4. Put your feet on the ball with your heels on the floor, do a movement of shaking your feet on the ball right and left as many as 8x right and left 5. Place your feet on the ball with your heels on the floor, and make a passing movement using the soles of your feet to the right and left as many as 8x right and left 6. Put your feet on the ball with your heels not attached to the floor, make a circular movement in one direction and counterclockwise as many as 8x right and left 7. Place the heel of the foot on the ball, and do the instep bending movement 8x right and left.	There are 10 foot exercises using a tennis ball, and each movement is repeated 8-16 times It is carried out every day 1x a day 14 times with a duration of 30 minutes

8. Place the heel of the foot on the ball, do the instep movement of the foot to bend outward as many as 8 times on the right and left legs 9. Pinch the ball with the inside of both feet. Perform a movement of lifting the ball up and down with the heel position attached as many as 8 times 10. Place the inside of both feet on the ball, do a back and forth movement with the soles of your feet attached to the ball 8 times 11. Position your feet with your heels together and place the ball between your feet, make a grasping motion, and release the ball 8 times	
Termination Phase	
• Ask if there is anything you want to ask after doing the activity • Asking how you feel after participating in the activity • Providing positive reinforcement • Explain again that foot exercises can be done every day 14 times with 1x repetition for 30 minutes • Ask the family to repeat what they have learned independently • Ending activities	It is carried out every day 1x a day 14 times with a duration of 30 minutes

The case study was carried out from August 5 to August 25, 2024, at a family house in Semanan I, West Jakarta Region RW 05. On the first day, the researcher conducted a home visit to the client by conducting nursing care in the form of a family health-based assessment (Friedman) coupled with foot health screening with a monofilament test and blood sugar checks at any time, determining the diagnosis and nursing intervention using the SMART principle. So, a nursing diagnosis emerged in the form of the ineffectiveness of health self-management (00294) with interventions provided in the form of health education about diabetes mellitus, teaching foot care, and prescribing exercises in the form of foot exercises using tennis balls. Furthermore, on the second day, they committed to foot training with tennis balls and provided education on the care of DM patients at home in the form of booklets, leaflets, and posters, namely care guidelines by caregivers for diabetes mellitus patients consisting of getting to know type-2 diabetes mellitus, setting up 3J diabetes mellitus diet, setting activity patterns in the form of diabetic mellitus foot exercises using tennis balls, foot care, the role of caregivers such as blood glucose checks, and anticipating unwanted events in diabetic mellitus patients. On the third day until the implementation of the next 14 days, foot exercises were carried out with foot exercises using a tennis ball every day for 30 minutes with 1 repetition of 1 evaluation of GDS measurements and foot health checks with a monofilament test. After completing the leg exercises, the patient was given the task to record in his daily logbook how many movements he did, whether there were any difficulties in his implementation, whether there were any other complaints. To encourage regular adherence, the researchers reminded participants to do exercises over the phone via the WhatsApp application every day during the first week (Mbada et al., 2022). In addition, home visits were conducted randomly to provide further support and ensure adherence to the exercise regimen (Collado-Mateo et al., 2021).

Table 2.
Results of pre and post-diabetic neuropathy (Monofilament test) and Blood sugar (GDS) assessment

1. Diabetic neuropathy: measurement with a total monofilament test of 10 points in the legs. If more than 4/10 indicates neuropathy
2. Blood sugar at any time: blood sugar measurement while using a glucometer if > 200 g/dl indicates an increase in blood glucose levels.

Outcome measures	Pre-test (R/L)	Post-test (R/L)
Diabetic neuropathy	Patient 1: 5/6	Patient 1: 2/0
	Patient 2: 2/3	Patient 2: 1/1
	Patient 3: 8/2	Patient 3: 2/3
Blood sugar during	Patient 1: 270	Patient 1: 233
	Patient 2: 300	Patient 2: 208
	Patient 3: 454	Patient 3: 355

This case study report talks about the application of foot exercises with foot exercises using tennis balls in type-2 diabetes mellitus patients who have symptoms of diabetic peripheral neuropathy with complaints of numbness and loss of sensitivity in the legs. The application of this foot exercise is carried out for 2 weeks by assessing the decrease in neuropathy points using a foot health form, monofilament test, and blood sugar check, which are then evaluated every third day.

Studies have shown that the majority of neuropathy problems are more common in the lower extremities as a complication of type-2 diabetes mellitus. Other studies are mostly in the adult age range because as cells age, they gradually develop resistance to insulin, resulting in a decrease in their ability to metabolize glucose (Yang, 2014). In addition, insulin synthesis by beta-pancreatic cells decreases and is suppressed. In the majority of female patients compared to men, the cause is a decrease in the hormone estrogen as a result of menopause. Estrogen regulates blood sugar levels and promotes fat accumulation, while progesterone normalizes blood sugar levels and facilitates the use of fat for energy (Mahboobifard et al., 2022). The hormones estrogen and progesterone have an impact on the cells that respond to insulin. Hormonal fluctuations that occur after menopause interfere with blood sugar regulation. Most are diagnosed with diabetic peripheral neuropathy, which affects the sensitivity of the lower extremities (Iqbal et al., 2018). Similarly, this study, given to male and female adult patients with a history of type-2 diabetes mellitus one to five years ago accompanied by complications of kidney failure, found edema in the upper and lower extremities of the right and left parts, high blood pressure, blood sugar that tends to be unstable, accompanied by problems in the lower extremity in the form of increased symptoms of numbing diabetic peripheral neuropathy, stiffness, tingling, itching in the legs, loss of sensitivity of the feet, scratches on the feet. The main problem felt by sufferers as a result of the instability of blood glucose in the body is peripheral neuropathy as a complication of diabetes mellitus with manifestations of peripheral nerve damage in the form of burning sensation, discomfort in the legs, itching sensation, muscle weakness, loss of leg sensitivity or numbness due to an increase in neuropathy points, foot wounds and infections resulting from reduced sensation in the legs.

Another study found that foot exercises with diabetic foot exercises offered some advantages that went beyond the foot area for individuals diagnosed with diabetes mellitus (Aagaard, Moeini, Skou, Madsen, & Brorson, 2022). Additional advantages included promoting increased physical activity and lowering blood glucose levels. Both domains had statistically improved results related to activities

designed specifically for diabetic foot care (Matos, Mendes, Silva, & Sousa, 2018a). Similarly, this study was given the application of diabetic foot exercises for 2 weeks, the results were obtained in the form of a decrease in blood glucose levels when from 270 g/dl to 233 g/dl with a commitment and increased physical activity in the form of diabetic foot exercises which were carried out 1 time a day with a duration of 30 minutes.

This diabetic foot exercise activity has been associated with an increase in endorphin chemicals that help relieve pain, dilate blood vessels, and dilate abnormal blood vessels so that they can cause a drop in blood pressure. In addition, doing diabetic foot exercises can increase impaired blood circulation and strengthen the intrinsic muscles of the legs in individuals with diabetes, so it has the potential to result in a decrease in blood pressure (Juhanis & Hasmyati, 2024). Studies have shown that practicing diabetic foot exercises regularly has a beneficial impact on the regulation of blood glucose levels, blood pressure control, and management of dyslipidemia and facilitates weight loss in patients with diabetes mellitus. Similarly, this study conducted diabetic foot exercises using a tennis ball every day for 30 minutes and obtained results in reducing blood pressure in 2 weeks with systolic and diastolic values of 120/80 mmHg.

The goal of diabetic foot exercises is to help overcome the decrease in neuropathy points in diabetic patients in the form of increasing nerve sensitivity, improving blood circulation, reducing pain and numbness, and improving balance as well as muscle strength. Diabetic patients who participated in foot exercises using tennis balls showed a decrease in peripheral sensory neuropathy (Eroğlu & Kutlutürkan, 2024b). This is because the movements involved in foot exercises can improve the performance of myelin and axon nerves, leading to increased nerve conduction, and sensitivity effectiveness is assessed by using a monofilament test In the intervention group showed a decrease in sensory peripheral neuropathy points, this supports that foot exercises can improve blood circulation and sensitivity. Similarly, this study carried out the application of foot exercises using tennis balls for 2 weeks and obtained results in the form of a decrease in the high risk of foot health, a decrease in neuropathy points measured using a monofilament test on the 3rd-day R/L: 5/6, the 6th-day R/L: 5/6, the 9th-day R/L: 4/5, the 12th-day R/L: 2/3, Day 15 R/L: 2/0 accompanied by reduced complaints of numbness, numbness, wounds and infections in the legs.

The application of foot exercises by using a tennis ball for 10-30 minutes 2-3 days per week a day effects after two weeks can reduce pain, improve nerve sensitivity by reducing symptoms of tingling and numbness, improve blood circulation, increase strength and flexibility of leg muscles, reduce swelling in the legs, and reduce the risk of falls as well as injuries to the legs. The study showed that there was a significant difference in the level of foot sensitivity after being given diabetic gymnastics with a tennis ball, which had the effect of improving the condition of the legs (Miladiana & Rosyid, 2024). The legs were warm, flexible, not numb, and not atrophied because there was no obstruction in peripheral blood circulation. The implementation of foot exercises using tennis balls is in line with a study with a duration of 30 minutes carried out every day by patients with type-2 diabetes mellitus who experience complications of kidney failure, there is edema in the legs, capillary refill time > 3 seconds, turgor skin is not elastic, cold ears and there are scratches after this implementation activity is carried out the results that there has not been a significant decrease in edema, but there is a decrease At < 3 seconds capillary refill time, the skin turgor is elastic, the aural is warm, and the degree of wound repair from stage II to stage I.

The study explains that the use of tennis balls in the implementation of diabetic foot exercises can improve blood circulation because the movement of rolling the tennis ball under the feet helps increase blood flow to the leg area (Dogra, 2021). The movement using a tennis ball can provide

pressure in the form of a light massage on the legs, which can relieve pain and muscle tension. Integrating tennis balls in foot exercises can improve foot sensitivity in people with diabetes. This activity can improve blood circulation and strengthen the intrinsic muscles of the legs, which are very important for people with diabetes. Integrating tennis ball exercises can improve balance performance, help relax muscles and ligaments, improve leg stretching, and result in improved static balance and leg flexibility. This exercise can also help in the wound healing process in diabetic patients who have foot ulcers and improve the general health of the feet (Matos, Mendes, Silva, & Sousa, 2018b). Thus, in this study, after diabetic foot exercises using tennis balls were carried out for 2 weeks every day for 30 minutes, there was an improvement in the degree of injury from stage II to stage I.

There are nine leg exercises using a ball, which are described in the form of warm-up exercises, intrinsic leg muscle strengthening, extrinsic leg muscle strengthening, leg muscle stretching, balance, gait, foot tapping, V-shape making, ankle rotating, and tenning ball rolling, these nine movements are carried out for the first 2 weeks for 30 minutes every day with 1-40 repetitions obtained the effect of increasing foot sensitivity, decrease of neuropathy points, improve joint mobility and muscle flexibility. Another study has ten leg exercises using a tennis ball that has been summarized and refers to the nine movements of the study above, and each movement has its own benefits to overcome this peripheral neuropathy problem. Diabetic foot gymnastics using a tennis ball is carried out with ten movements in line with the Movement movement of stepping on the ball, namely positioning the feet on the ball, moving forward and backward as many as eight times with the position of the soles of the feet on the ball, this back and forth movement helps increase blood flow to the legs, the massage from the tennis ball relieves muscle tension and reduces pain in the legs. Put your foot on the ball with your heel attached to your foot. Perform a movement of holding the ball with your toes as many as 16x right and left. This movement of grasping the ball is likened to a stretch that can maintain flexibility and prevent stiffness in the toes, strengthening the small muscles in the toes important for balance and stability (Nelson & Kokkonen, 2020). Place your feet on the ball with your heels on the floor, do the movement of swinging your feet on the ball to the right and left as many as 8 times, this ankle rotation movement helps increase the range of motion of the joints, which are important for mobility, reduce swelling by improving lymphatic circulation and blood. Place your feet on the ball with your heels on the floor; perform the movement of passing the ball using the sole of the foot to the right and left 8 times. This movement helps improve coordination between the right and left feet and helps improve sensitivity and nerve response. Put your feet on the ball with the heel position not attached to the floor (Franklin, 2022). Perform a circular movement in one direction and counterclockwise as many as 8 times right and left; this movement helps improve the balance and stability of the ankle and maintain the mobility of the ankle joint. Put the heel of the foot on the ball and do the inward bending of the back of the foot movement 8 times right and left; this movement helps strengthen the calf and ankle muscles and increases the flexibility of the muscles and tendons in the foot. Put the heel of the foot on the ball and do the instep bending outward movement 8 times on the right and left legs; this movement increases the flexibility and mobility of the ankle itself and reduces stiffness in the muscles and joints. Clamp the ball with the inside of both feet. Perform a movement of lifting the ball up and down with the heel position attached 8 times. This movement helps strengthen the leg and ankle muscles, helping to coordinate the leg muscles. Place the inside of both feet on the ball and do a back-and-forth movement with the position of the soles of the feet attached to the ball 8 times; this grinding movement helps increase the strength and flexibility of the leg muscles, helps increase blood flow to the legs. Position the feet with the heels attached to each other and place the ball between the two feet, do a grasping

movement, and release the ball 8 times; this movement helps strengthen the muscles and ankles and improve coordination between the leg muscles.

A tennis ball can be used as a medium for diabetic foot gymnastics because the tennis ball gently massages the foot with enough pressure without causing discomfort (Saumaa, 2024a). Tennis balls offer good resistance, allowing the toes to perform effective stretches and contractions. The tennis ball has a stable, flexible surface that allows for easy ankle rotation. The tennis ball provides sensory stimulation and is easy to roll. The tennis ball has an ideal surface for smooth and controlled spinning movements. The tennis ball has good resistance for leg bending practice without causing injury. The tennis ball is easy to grip and provides an ideal surface for grinding movements. Tennis balls make the practice more effective and enjoyable. The use of tennis balls can provide a massage effect on the feet, allowing the blood to carry more oxygen and nutrients to the cells of the body while at the same time releasing more toxins. Diabetic gymnastics done on the soles of the feet, especially in the affected organ areas, will stimulate the nerve points related to the pancreas to become more active, this will prevent the development of complications in the legs by producing insulin through the nerve points on the soles of the feet (Saumaa, 2024b).

In this study, foot gymnastics using a tennis ball can show a decrease in peripheral neuropathy points, lower blood glucose levels at any time, lower blood pressure, and improve foot health conditions measured using foot health examination forms, monofilament tests, and glucometers. Physical exercise recommended by people with diabetes mellitus by doing foot exercises with a tennis ball, which is applied for 2 weeks, is carried out every day with a duration of 30 minutes. Can overcome symptoms of peripheral neuropathy such as reduced numbness, reduced stiffness, reduced numbness, increased foot sensitivity, decreased neuropathy points, and reduced incidence of injuries to the legs. In addition, physical exercise with foot exercises using tennis balls also reduces costs, its implementation is efficient and effective.

CONCLUSION

Therefore, to prove the implementation of nursing care by completing the diagnosis of nursing ineffectiveness of self-management of family health, the author tries to apply foot exercises in the form of foot exercises using tennis balls, which play an important role in overcoming problems related to diabetic peripheral neuropathy so as to avoid complications of peripheral ischemia that trigger amputations. Not only can this foot exercise help overcome the problem of peripheral neuropathy, but it can also improve the quality of life of diabetic mellitus patients.

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