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Enhancing Foot Sensitivity in Diabetes Mellitus Patients: The Impact of Diabetic Foot Exercises

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ABSTRACT

Physical activity is an essential way for people with Diabetes Mellitus, especially in dealing with increased sensitivity of the foot. Diabetic foot gymnastics is an exercise performed by DM patients to prevent injuries, help smooth blood circulation, and increase foot sensitivity. The study was designed as a one-group pre and post-test design. The study was conducted on 22-26 May 2018 at the Public Health Center of Peterongan. The sample consisted of 35 respondents using the Purposive Sampling technique. The Independent variable was Diabetic foot gymnastics; the dependent variable was foot sensitivity. The results of analysis used the Wilcoxon test at significance level α = 0.05 was found that ρ <α or 0,000 <0.05, which means that there was an influence of diabetic foot gymnastics with plastic ball to the level of foot sensitivity in DM patients, in which pre-test of half respondent (54.3%) sensitivity of the foot of the ring as many as 19 respondents, and after the post-test become higher as many as respondent (42.9%) had their sensitivity of the foot of the ring as many as 15 respondents. A sensory examination of the foot was required. Because of these results, the risk of complications in the foot could be prevented as early as possible. Normal foot sensation and abnormal foot sensation were sometimes not known by people with diabetes mellitus as one of the factors of diabetic foot gymnastics.

Keywords: Foot Gymnastic, Foot sensitivity, Diabetes mellitus

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1. INTRODUCTION

Diabetes Mellitus (DM) is a major health concern worldwide, ranking among the leading causes of death. The World Health Organization (WHO) has predicted a steady rise in diabetes cases, making it a significant global health threat (Bommer et al., 2018). DM is often called a "lifelong disease" because there is no cure. One of the most common complications in people with diabetes is neuropathy, which occurs due to consistently high blood sugar

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levels. Over time, this can cause serious damage to blood vessels, nerves, and other internal structures (Bril et al., 2019).

For people with diabetes, proper foot care is essential to prevent complications. Simple habits like washing feet regularly, wearing socks, and avoiding walking barefoot can make a big difference (Adeyemi et al., 2021). Taking care of the feet is a key part of preventing further complications and reducing the risks associated with DM.

In Indonesia, the Ministry of Health reports that the average prevalence of diabetes among people aged 15 and older is 5.7% (Wahidin et al., 2024). This number is even higher in East Java Province at 6.8%, with 102,399 reported cases. In Jombang, diabetes ranked the fifth most common disease in 2022, affecting 16,490 people (5.30%). The highest number of cases was recorded in Peterongan District, where 2,681 people were living with diabetes that year. In 2017, 459 DM-related patient visits were recorded at the Peterongan Health Center.

Managing diabetes effectively requires a comprehensive approach. There are four key pillars of diabetes care such as education, medical nutrition therapy, exercise, and medication (American Diabetes Association, 2018). Regular exercise has long been recognized as a crucial part of Type II diabetes management, alongside a healthy diet and medication (Magkos et al., 2020). Physical activity, particularly foot exercises, improves foot sensitivity in people with diabetes. One practical and recommended method is diabetes mellitus foot gymnastics.

2. METHODS

This study used a pre-experimental research design with a one-group pre-test and post-test approach. The population consisted of all diabetes mellitus (DM) patients at the Peterongan Health Center, averaging 38 patients per month. 35 DM patients from the Public Health Center of Peterongan, were selected as respondents from this population.

The sampling method used was purposive sampling, selecting participants based on specific criteria relevant to the study. The independent variable in this study was diabetic foot exercises, while the dependent variable was foot sensitivity. Data was collected using a checklist to assess foot sensitivity before and after the intervention. Data processing and analysis were performed using statistical software. The Wilcoxon test was used to analyze the effect of diabetic foot exercises on foot sensitivity levels in diabetes mellitus patients.

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3. RESULTS

Table 1. Respondent Characteristics (N=35)

Characteristics	Frequency	Percentage (%)
Jobs		
Private employment	10	28.6
Self-employed	21	60.0
Retired from civil servants	4	11.4
Received health information		
Ever	8	22.9
Never	27	77.1
Source of health information		
Health Workers	6	17.1
Friends/Neighbors	2	5.7
Never	27	77.1

Table 1 shows that most respondents (60%) are self-employed, as many as 21 people. Almost all respondents (88.6%) had no family history of the disease suffered by as many as 31 people. Most respondents (77.1%) never received information from 27 people; most of the respondents never received information from health workers as many as 27 respondents (77.1%). Table 2 shows that most respondents with moderate foot sensitivity were 19 (54.3%), and most respondents with moderate foot sensitivity were 15 (42.9%).

Table 2. Frequency distribution of respondents based on before and after diabetic foot exercise with plastic balls on the level of foot sensitivity in DM patients

Foot sensitivity	Before		After	
	f			%
Insensitivity	6	17.1	0	0
Lightness	19	54.3	15	42.9
Medium	10	28.6	13	37.1
Hard	0	0	7	20.0

Table 2 shows that the majority (54.3%) of foot sensitivity in DM patients before diabetic foot exercise with a plastic ball of 19 people was classified as mild and changed to 15 people (42.9%) who were classified as mild. The level of foot sensitivity in DM patients before diabetic foot exercise with a plastic ball was 0 people (0%), and after diabetic foot exercise with a plastic ball was 7 people (20%).

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Table 3. Results of the Wilcoxon sign rank test

	Post-test-Pre-test
Z	-2.731[a]
Asymp.sig. (2-tailed)	.006

Based on the results of the Wilcoxon Signed Rank Test calculation, the Z value obtained is -2.731 with a p value (Asymp. Sig 2 tailed) of 0.006 which is less than the research critical limit of 0.05 so that the hypothesis decision is to accept H1, which means there is a significant difference between the pre-test and post-test groups.

4. DISCUSSION

Based on the result, it is known that the majority (54.3%) of foot sensitivity levels in DM patients before diabetic foot exercise with the plastic ball were light, as many as 19 people and heavy, 0 people (0%), and after diabetic foot exercise with plastic ball became 7 people (18.4). These foot exercise movements can improve blood circulation, strengthen leg muscles, and improve the movement of foot joints. Thus, people living with diabetes can maintain their health and improve the quality of life of diabetes sufferers (Trikkalinou et al., 2017)

According to researchers, lack of activity or physical exercise reduces foot sensitivity. The prevention of complications is the regularity of DM patients in physical activity/sports. Gymnastics is expected to maintain body fitness, lose weight, and increase insulin sensitivity to improve blood sugar levels. Physical activity that is also recommended to be done routinely by DM patients is diabetic foot exercise movements (Colberg et al., 2016; Kurdi & Priyanti, 2020). Diabetic foot exercises that are done routinely are expected to prevent complications that often occur in the feet of DM patients, such as wounds that do not heal and spread widely do not occur.

Research results shows that the majority (57.1%) of self-employed respondents have moderate sensitivity. Work is a collection of tasks or activities that someone must complete according to their positions or professions. Low-status jobs often affect a person's level of knowledge (Kossek & Lautsch, 2018).

According to researchers, work is one of the important determinants of health. The type of work and working conditions of a person play a role in influencing a person's health. The more established a person's job, the more they will be able to improve their health, especially in

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preventing diabetic ulcers in various ways such as checking their foot conditions regularly with health workers or buying special footwear that is adjusted to the shape of the foot.

Based on the result, it is known that most (51.9%) of respondents who never received information have light sensitivity. The respondents who never received information had less knowledge, and respondents who never received information had less knowledge, which could impact the foot sensitivity level in DM sufferers. If knowledge develops very quickly, information also develops very quickly. Sources of information will hone someone's thinking so that a person's knowledge will increase. The better the information obtained, the better the level of foot sensitivity in DM sufferers (Bullen, 2022).

The lack of accurate information about DM causes respondents to be limited to what they know first (Tuglo et al., 2022). On the other hand, if respondents receive regular and correct health education, they have substantial knowledge and memory power regarding the information previously given about the correct handling of DM.

Based on the results of the Wilcoxon Signed Rank Test, the Z value was obtained at -2.731 with a p-value (Asymp. Sig 2 tailed) of 0.006, which is smaller than the critical limit of the study of 0.05 so that the hypothesis decision is to accept H1 or which means there is a significant difference between the pre-test and post-test groups. Foot exercise can help smooth blood circulation, strengthen small leg muscles, and prevent foot deformities (Afida et al., 2022). In addition, it can increase the strength of the calf muscles, both calf muscles and thigh muscles and overcome limited joint movement (Green, et al., 2022). Physical exercise will cause increased blood flow. The capillary network will be more open so that the available insulin receptors will increase, and these receptors will become more active, affecting the decrease in blood glucose levels in diabetic patients (Kurdi, et al., 2020; Li et al., 2023). There are two actions in the basic principles of diabetic foot care, namely preventive actions and rehabilitation actions (Wang et al., 2022). Foot Exercise is performed by people with diabetes mellitus and non-diabetes to prevent injury and help smooth blood circulation in the feet (Lazzarini et al., 2023). To improve foot vascularity, foot exercise movements known as Diabetic Foot Exercise can also be performed (Afida et al., 2022; Aydın & Ertuğrul, 2021). Peripheral neuropathy causes loss of sensation and pain in the affected

extremities of the feet in individuals with diabetes (Elafros et al., 2022).

In diabetic neuropathy, tingling and other symptoms often appear in both feet to the ankles and knees, other symptoms that affect both hands to the arms. Control Good glucose control can slow the progression of diabetic neuropathy (Joshua & Misri 2022). According to researchers, a sensory examination of the feet is to determine whether or not there is a sensory disorder in the feet that underlies the occurrence of the sensory disorder by knowing the sensation felt by the patient, namely a normal sensation or an abnormal sensation. According to researchers, the results of a sensory examination of the feet are significant. Because of these results, the risk of foot complications can be known so that prevention can be done as early as possible. Sensation Normal foot sensation and abnormal foot sensation are sometimes not known by people with diabetes mellitus as one of the factors in diabetic foot ulcers. Therefore, the purpose of the foot sensory examination is to determine whether or not there is a decrease in sensation in the feet as a sign that influences the onset of neuropathy symptoms. In addition to foot exercises, researchers expect respondents to do physical activity/sports often. All humans need to do self-care and have the right to do self-care independently unless the person cannot do so. According to Orem (in Alligood, 2014), self-care is an activity to meet the needs of maintaining the life, health, and well-being of individuals in healthy and sick conditions, which the individual himself carries out. Individuals desire to prevent complications with the regularity of DM patients when doing physical activity/sports (Alligood & Tomey, 2006). Exercise is expected to maintain body fitness, lose weight, and increase insulin sensitivity to improve blood sugar levels. Physical activity that is also recommended to be done routinely by DM patients is diabetic foot gymnastics. Diabetic foot exercises that are done routinely are expected to prevent complications that often occur in the feet of DM patients, such as infected wounds that do not heal and spread widely.

5. CONCLUSION

Based on data analysis and discussion on the effect of diabetic foot exercise with a plastic ball on the level of foot sensitivity in DM patients, it can be concluded as follows:

The level of foot sensitivity in diabetes mellitus patients before diabetic foot exercise with a plastic ball was mild for 19 respondents (54.3%).

The level of foot sensitivity in diabetes mellitus patients after diabetic foot exercise with a plastic ball was moderate for 15 respondents (42.9%).

Based on the results of the Wilcoxon Signed Rank Test calculation, the Z value obtained is -2.731 with a p value (Asymp. Sig 2 tailed) of 0.006 which is less than the research critical limit of 0.05 so that the hypothesis decision is to accept H1 or which means there is a significant difference between the pre-test and post-test groups.

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AUTHOR CONTRIBUTIONS

Substantial contribution to conception, data collection: Nuraini Achmad Uba, Alik Septian Mubarrok, Fahruddin Kurdi. Analysis, writing manuscript and revision: Nuraini Achmad Uba and Fahruddin Kurdi.

CONFLICT OF INTEREST

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

DATA AVAILABILITY STATEMENT

The data are not publicly available due to privacy or ethical restrictions.

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