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THE EFFECT OF BUERGER ALLEN EXERCISES ON DIABETES MELLITUS PATIENTS' FOOT SENSITIVITY OF MANTANG HEALTH CENTER WORKING AREA IN 2021

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Abstract

Diabetes mellitus is a chronic metabolic disease that requires medical care and independent management education for the use of complications. Diabetes mellitus complications often occur. One is the sensitivity of the leg. Physical training is essential to keep the vascularity, strengthen the leg muscles, and prevent complications sensitivity feet. This study aims to acknowledge the effect of Buerger Allen exercise on the sensitivity of the feet of patients with diabetes mellitus in the Mantang Health Centre work area in 2021. This research used a pre-experimental design method with the form of one group pretest-posttest. The sample in the study amounted to 19 respondents, with the sampling technique being purposive sampling. The research instrument used a monofilament of 10 g to measure foot sensitivity. Data analysis was processed using the Wilcoxon test. Based on the results of the study, it was shown that the average sensitivity values of the feet on the right and left legs before the Buerger Allen exercise were 6.63 and 6.58. In contrast, the average value of the sensitivity of the feet on the right and left feet after the Buerger Allen exercise had increased as much as the respectively. 9.47 and 9.63. The results showed the effect of the Buerger Allen exercise on foot sensitivity (p-value = 0.000). Thus, Buerger Allen's exercise affects the sensitivity of the feet of patients with diabetes mellitus in the Mantang Health Centre working area in 2021.

Keywords: Buerger Allen exercise; Diabetes Mellitus; foot sensitivity

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Introduction

Diabetes Mellitus (DM) is a metabolic disease which is characterized by an excess of glucose levels in the blood (hyperglycemia) that occurs due to abnormalities in insulin secretion, insulin action, or both (ADA, 2016). The number of cases and the prevalence of DM has continued to increase over the last few decades (Kemenkes, 2018). DM is a significant public health problem, becoming one of the world leaders' four priority non-communicable diseases for follow-up.

According to the World Health Organization (WHO), the number of DM patients is 422 million. Based on the results of the International Diabetes Federation (IDF) report, there were around 199 million DM patients, estimated to increase to 313 million people by 2040. Indonesia is in the top 10 countries, with DM patients in 6th place. DM aged more than 15 years is 6.9% or about 12 million people (Carracher, Marathe, & Close, 2018).

According to the Report on Result of National Basic Health Research 2018, the prevalence of DM in the population aged 15 years in Indonesia from 2013 to 2018 experienced a significant increase, from 1.5% to 2.0%. West Nusa Tenggara is in the 22nd position, which also experienced an increase in the prevalence of DM, from 0.9% to 1.64%. In Central Lombok Regency in 2018, there was a prevalence of DM who received health services in many as 1,776 cases, and in 2019 there was an increase in the majority of DM patients, as much as 3,692 cases or 9.1% of the estimated number of DM. Community Health Centre with DM patients receiving the highest health services was at Pengadang Health Center with 685 cases, Darek Health Center with 544 cases, Praya Health Center with 401 cases, Sengkol Health Center with 348 patients, and Mantang Health Center with 306 instances (Central Lombok Health Office, 2019)

The high number of DM patients is partly due to lifestyle changes (Annisa, 2020). Unhealthy lifestyle changes such as excessive food (fat and lack of fibre) can increase blood sugar levels. Hence, the feet experience tingling or numbness, leading to neuropathy and decreased sensitivity to the feet (Damayanti, 2015).

Foot sensitivity is a stimulation in the isolated area obtained by the nerves and causes various problems called neuropathy. The increased activity of the lower extremities will cause high red blood cell aggression, so blood circulation becomes slow and causes circulation disorders (Rusandi, 2014). DM management begins with implementing a healthy lifestyle and pharmacological interventions with oral and injection of anti-hyperglycemic drugs. DM management other than pharmacologically must be accompanied by non-pharmacological therapy such as counselling or education, medical nutrition therapy, and physical exercise or physical activity (Indonesia, 2019).

Exercise (physical activity) can directly improve physiological function by reducing blood glucose levels, increasing stamina and emotional well-being and increasing circulation. Physical activity will cause an increase in blood flow, so there will be more open capillary nets so that more insulin receptors are available and receptors become active, which will affect DM patients (Soegondo, 2014). Although swimming and brisk walking have been suggested as good choices, other types of activity are equally beneficial, particularly the Buerger Allen exercise (Suryati, Murni, & Arnoval, 2019).

Buerger Allen Exercise is one form of active movement in the plantar area that applies the force of gravity. Regular exercise will help increase arterial and venous blood flow by opening small blood vessels in the muscles (capillaries), blood vessel vascularization, and blood supply in the tissues (Salindeho, Mulyadi, & Rottie, 2016). Therefore, each stage of the training must be done regularly (Chang et al., 2016).

Based on the description above, the researcher is interested in conducting a study entitled "The Effect Buerger Allen Exercise on Foot Sensitivity of Diabetes Mellitus Patients in the Work Area of the Mantang Health Center in 2021".

Method

Research design pre-experimental that uses a one-group pre-post test design. The population in this study were all DM patients recorded at the Mantang Health Center in the last 10 months starting from January-October 2020, as many as 306 people. The sample in this study was 19 respondents. In this study, the sampling technique used was purposive sampling. The analysis used in this study is the Wilcoxon.

Results and Discussion

A. Results

The results of this study will be described as follows:

Table 1
Frequency distribution of respondents based on characteristics

Characteristics	Total	(%)
Age		
45-54 years old	7	37
54-64 years old	8	42
>65 years old	4	21
Total	19	100
Gender		
Female	12	63
Male	7	37
Total	19	100
Education		
Do not study at school	4	21
Elementary school	8	42
High school	5	26
College	2	11
Total	19	100
Occupations		
Do not work	9	48
Trader/ Farmer	4	21
Self-employed	4	21
Civil Servants	2	10
Total	19	100

Based on table 4 above shows that the most significant number of respondents in this study were in the age range of 54-64 years, namely 8 people (42%), and the lowest number of respondents was >65 years of age, as many as 4 people (21%), most of them were women 12 people (63%). Most have primary education as many as 8 people (42%). Meanwhile, the job characteristics show that most respondents are not working as many as 9 people (47.5%), and the lowest job is a civil servant as many as 2 people (10.5%).

Table 2
Average sensitivity value before the intervention of Buerger Allen exercise

Category	Right leg	%	Left leg	%
Normal (score 10)	0	0	0	0
Decreased (score <10)	9	42	6	32
Total	19	100	19	100

The table above shows that the results measuring the sensitivity of the right foot and left foot, as many as 19 people (100%) of respondents experienced a decrease in foot sensitivity.

Table 3
Foot sensitivity category after Buerger Allen exercise intervention Leg

Category	Right foot	%	Left foot	%
Normal (score 10)	11	58	13	68
Decreased (score <10)	9	42	6	32
Total	19	100	19	100

Table 3 shows that the sensitivity measurement results foot after *Buerger Allen exercise*, and on the left foot, as many as 13 people (68%) experienced an improvement in sensitivity.

Table 4
Wilcoxon test results in research on the effect of *Buerger Allen exercise* on foot sensitivity of diabetes mellitus patients in the work area of Mantang

		n	Min	Max	Mean	SD	*p*
Leg sensitivity pre-test	Right foot	19	5	9	6.63	1.212	0,000
	Left foot	19	5	8	6.58	0.961	
Leg sensitivity *posttest*	Right foot	19	8	10	9.47	0.697	0,000
	Left foot	19	8	10	9.63	0.597	
α = 0,05							

The table above shows that the results in the pre-test obtained an average right foot sensitivity value of 6.63 with a standard deviation of 1.212 and an average foot sensitivity value of 6.58 with a standard deviation of 0.961. Meanwhile, the post-test obtained an average sensitivity value on the right foot, which was 9.47 with a standard deviation of 0.697, and a mean on the left foot was 9.63 with a standard deviation of 0.597. The right foot has a minimum value of 5 and a maximum value of 9. The left foot has a minimum value of 5 and a maximum value of 8. The right leg has a minimum value of 8 and a maximum value of 10. On

the left foot, it has a minimum value of 8 and a maximum value of 10.

The results of statistical tests using the Wilcoxon on the SPSS 16.0 computerized system obtained a p-value = 0.000 < 0.05, where the hypothesis is null (H_0) is rejected, or the alternative hypothesis (H_a) is accepted, which means "There is an Effect Buerger Allen Exercise on Foot Sensitivity of Diabetes Mellitus Patients in the work area of the Mantang Health Center in 2021".

B. Discussion

Based on the foot sensitivity data obtained before the Buerger Allen exercise, 19 respondents (100%) experienced foot sensitivity problems. The measurement results show that the average sensitivity value of the right foot is 6.63, and the average sensitivity value of the left foot is 6.58.

Foot sensitivity is stimulation in the isolated area affected by nerves and causes various neuropathy problems. Increased lower extremity reactivity will cause high red blood cell aggression, so blood circulation becomes slow and impaired foot sensitivity. The factors that influence the increase in foot sensitivity of diabetic patients are caused by age, gender, education, and occupation (Prasetyo, 2017). Factors that affect the skin to stimuli include gender. It is also influenced by the thickness of the skin (Wagner et al., 2001). Different skin thicknesses can produce different touch sensitivity. This is because the sensory nerve endings are located in the dermis tissue right at the border of the epidermis and dermis (Kolarsick, Kolarsick, & Goodwin, 2011).

The average elderly who had just experienced DM was more than 50 years old (Fathoni, Purnamawati, & Syafitri, 2019). Generally, human age undergoes physiological changes that drastically decrease rapidly after the age of 40 years. This decrease will risk a reduction in the endocrine function of the pancreas to produce insulin and affect the sensitivity of the receptors to decrease so that glucose in the blood increases (Fathoni et al., 2019). This is associated with a decrease in the sensitivity of the patient's feet (Sudoyo, 2009).

The incidence of DM is higher in women compared to men. Hormones estrogen and progesterone affect how cells respond to insulin (Clinic, 2010). After menopause, changes in hormone levels will trigger fluctuations in blood sugar levels. This causes the incidence of DM to be higher in women than men (Clinic, 2010).

People with a high level of education will usually have a lot of health knowledge. With this knowledge, people will have aware of maintaining their health (Irawan, 2010). Moreover, unhealthy eating patterns and lack of physical activity trigger DM (Hariawan, Fathoni, & Purnamawati, 2019). Work makes the body less mobile and can be a trigger for obesity. This will cause the body's tissues to become less sensitive to the effects of insulin. So blood sugar is in the blood and is difficult to leave and enter the cells. This aligns with ADA (2016) statement that physical activity has significant benefits because blood glucose levels can be controlled through physical activity and prevent complications. One complication that occurs is neuropathy, which affects the sensitivity of the feet as a sign that affects the symptoms of complications.

Based on the study's results on 19 respondents after doing the Buerger Allen exercise, the measurement of foot sensitivity increased compared to before doing the Buerger Allen exercise. The number of respondents for the normal category on the right foot is 11 people (58%), and on the left foot is 13 people (68%). Meanwhile, the average sensitivity value of the foot that improved on the

right foot was 9.47, and the average sensitivity value on the left was 9.63.

This theory is supported by the idea of Nasution (2010), which states that leg exercises can help improve the small muscles of the feet in diabetic patients with neuropathy. In addition, it can strengthen the calf and thigh muscles, overcome the limitations of joint motion and prevent deformities. The limited amount of insulin in people with diabetes mellitus can cause blood sugar levels to increase. This can cause damage to blood vessels, nerves, and other internal structures, thereby obstructing the blood supply to the legs. As a result, diabetic patients will experience impaired blood circulation in their legs. Thus, with foot exercises in the form of Buerger Allen exercise, patients with diabetes mellitus will be able to increase the supply of blood flow to the feet so that changes in foot sensitivity increase (Nasution, 2010).

Exercises that are carried out to increase the circulation of microvascular blood flow in the muscles must be carried out continuously and repeatedly. This is associated with widening of the arteries (vasodilation) and increased capillary permeability, allowing glucose absorption by cells (Rosales-Valderrain et al., 2013). Moreover, regular physical exercise increases muscle capillary density and insulin sensitivity in individuals with type 2 diabetes (Colberg et al., 2016). Average blood circulation allows blood to deliver more oxygen and nutrients to body cells. Buerger Allen exercise is one of the variations of active movement in the plantar area by applying the force of gravity so that each stage of the training must be done regularly. Excellent and regular exercises can help increase arterial and venous blood flow by opening capillaries (tiny blood vessels in the muscles). This movement increases the vascularity of blood vessels, thereby increasing the blood supply in the tissues (Salindeho et al., 2016).

Mellisha (2016) found that to assess the effectiveness of Buerger Allen exercise against peripheral perfusion disorders and lower extremity pain in DM patients, and the evaluation can be carried out on day six. The results pre-test the pain level of 4.33 (SD 1.88) with (p-value = 0.001). in addition, according to research conducted by John and Rathiga (2015), the Buerger Allen exercise with an exercise duration of 10-15 minutes 2 times a day for 5 days can improve circulation. Furthermore, a post-test was carried out on day 5 using the ankle-brachial index (ABI). The result is that (p-value = < 0.05). Turan's (2015) research shows that Buerger Allen exercise can increase blood supply to the extremities and potentially cause the formation of new vascular structures. Vijayabarathi (2016) proved that Buerger Allen exercise could increase vascularization and blood supply to the injured area in people with type 2 diabetes mellitus (such as ulcers and gangrene), thus helping the wound healing process.

Based on the results of the study for 1 week, which was carried out for 4 days alternately a day, carried out in the morning and evening, the results in the pre-test obtained an average right foot sensitivity value of 6.63 with a standard deviation of 1.212 and an average left foot sensitivity value of 6.63. 6.58 with a standard deviation of 0.961. The right foot has a minimum value of 5 and a maximum value of 9. On the left foot, it has a minimum value of 5 and a maximum value of 8. Meanwhile, the post-test obtained an average sensitivity value on the right foot, which was 9.47 with a standard deviation of 0.697, and a mean on the left foot was 9.63 with a standard deviation of 0.597. the right foot has a minimum value of 8 and a maximum value of 10. On the left foot, it has a minimum value of 8 and a maximum value of 10.

The results of statistical tests using the Wilcoxon on the SPSS 16.0 computerized system obtained a p-value = 0.000 < 0.05, where the hypothesis is null (H_0) is rejected or the alternative hypothesis (H_a) is accepted, which means "There is an Effect Buerger Allen Exercise on Foot Sensitivity of Diabetes Mellitus Patients in the work area of the Mantang Health Center in 2021".

This study's results align with Endriyanto's (2012) research, which states that physical activity can increase foot sensitivity. Because it can improve blood flow, strengthen small muscles, prevent foot deformities, overcome joint motion limitations, and enhance the fitness of diabetes mellitus clients. Therefore, doing Buerger Allen exercise can help increase foot sensitivity in people with diabetes mellitus (Endriyanto, 2012). This research was corroborated by Chang et al. (2016) found that the Buerger Allen exercise positively impacts circulation, improves blood flow, improves walking ability, reduces necrosis, and prevents embolism, pain, and cyanosis in blood vessels. Buerger Allen exercise is effective in improving lower extremity perfusion among patients with diabetes mellitus; there is a significant increase in more inadequate extremity perfusion and pain reduction in patients who have been given Buerger Allen exercise in type 2 DM patients. Gravity helps to empty the veins and fill the blood vessel column. Arteries alternately in the legs, ultimately increasing blood transport through leg exercises (Bottomley, 2007).

CONCLUSION

Based on the results of this study, the results of statistical tests that researchers have carried out show that Buerger Allen exercise affects foot sensitivity in patients with diabetes mellitus. Buerger Allen exercise is one of several other non-pharmacological measures that can help increase foot sensitivity in patients with diabetes mellitus.

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