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Original Article

The Effect of Aerobic Exercise Frequency on Reducing Blood Glucose in Type 2 Diabetes Mellitus Sufferers in the Lingsar Health Center Working Area in 2024

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ABSTRACT

One of the keys to a person suffering from diabetes mellitus being able to live a healthy life like other people without diabetes is to maintain balanced blood glucose levels within normal limits. One important way to reduce blood glucose levels, especially in type 2 DM sufferers, is exercise. This study aims to identify the effect of aerobic exercise, on changes in blood glucose levels. This research is a pre-experimental research with a one group pre-posttest approach. The research sample was 33 people suffering from type 2 DM at the Lingsar Community Health Center, selected using a simple random sampling technique. Each respondent was given aerobic exercise 3 times a week with a minimum duration of 20 minutes. Data on blood glucose levels before and after the intervention were collected using an observation sheet. The results of the study showed that the average blood glucose before the intervention was 162.2 mg/dL and after the intervention it fell to 156.14 mg/dL. The t-test with α=0.05 showed ρ=0.000. It can be concluded that there is an effect of aerobic exercise on the respondents' blood glucose levels. Aerobic exercise has been proven to reduce the average blood glucose level after this is done regularly. This study results can be an evidenced base for community nursing to promote regular aerobic exercise among people with DM, to help reduce or control their blood glucose.

Keywords: *Aerobic; Exercise; Blood Glucose; type 2 diabetes mellitus*

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INTRODUCTION

Diabetes mellitus is an important health problem and is one of the priority non-communicable diseases that is the target of follow-up and is a serious threat to global health. The International Diabetes Federation (IDF) reports that every year, there is an increase in the prevalence of diabetes globally.[1] Hyperglycemia's long-term impact can damage various body systems, especially the nerves and blood vessels.[2]

The International Diabetes Federation (IDF) has estimated that about 537 million people aged 20-79 suffered from DM in 2021, and this number will potentially rise to 783 million by 2045. If the prevalence of diabetes is ranked, countries in the Arab-North African and West Pacific regions are ranked first and second with a prevalence of diabetes in the population aged 20-79 years of 12.2% and 11.4%. The third rank is occupied by the Southeast Asia region, where Indonesia is located, with a prevalence of 11.3% with 1.017.290 cases.[1]

In West Nusa Tenggara (NTB) province, the number of Diabetes Mellitus sufferers reached 64.544 people in the first semester of 2023.[3] Three cities with the highest prevalence of DM were East Lombok, Central Lombok and West Lombok. Although the cases in West Lombok are in 3rd place among other cities in NTB Province with a total of 9.366 people, the percentage of DM sufferers who received standard intervention for diabetes was

considered low (only 54%).[3] In West Lombok number of DM sufferers who received the least standard intervention for diabetes were live in the working area of Lingsar Health Center. While the intervention for diabetic still low, according to data from Lingsar Health Center, the number of people suffered from DM in this area continue to rise, from 384 in 2022 to 406 people in 2022.[4]

The situation in the working area of Lingsar Health Center indicated the importance of providing diabetes intervention to minimize the number of people suffering from Diabetes and to help diabetes sufferers maintain their blood glucose level in normal limit. Maintaining normal blood glucose level is a key for people with diabetes to be able to live a healthy life like other people without diabetes. One important way to reduce blood glucose levels, especially in type 2 DM sufferers, is exercise. However, based on information from an interview with the head of Lingsar Health Center and the Coordinator of diabetic intervention, people with diabetes were only treated with anti-diabetes drugs and education about diet, and never received education about exercise.

One type of exercise can be performed to help people with DM maintain normal blood glucose is Diabetes exercise. This is an aerobic physical exercise for diabetes mellitus sufferers with a series of movements chosen deliberately following the rhythm of music so as to create certain rhythmic, continuity and duration provisions to achieve certain goals. Diabetes exercises are best performed in 45 minutes with a frequency of 3-5 times per week. When exercising, muscles contract and then relax. Sugar will be used or burned for energy. Sugar is transferred from the blood to the muscles for energy needs during and after exercise. Thus, the blood sugar will decrease. In addition, exercise makes insulin more sensitive.[5] 2017). However, no previous study identifies the significant effects of diabetes aerobic exercise among diabetic sufferers in the working area of Lingsar Health Center. This study aims to identify the effect of aerobic exercise for diabetic sufferers, on changes in blood glucose levels

METHODS

This research is a pre-experimental study with a one-group pretest-posttest design. It was conducted after receiving ethical clearance from the Ethics Commission of the Ministry of Health, Mataram Health Polytechnic. The sample consisted of 35 people chosen among the diabetic sufferers in Lingsar Health Centre using a simple random sampling method in April 2024. Each respondent was given aerobic exercise three times a week for a minimum duration of 20-25 minutes.

The movements were performed for 10 minutes in the form of static stretching movements and 10 minutes movements that resemble aerobic gymnastics movements. The movements begin with a warm-up, which includes head and shoulder exercises and arm rotations. The main movements were performed 15-20 minutes including hands up and down, move front and back, flexion and extension, followed with legs movements including flexion and extension and walking on the spot. These movements then followed with cooling movements in 5 minutes.

Data on blood glucose levels were collected using a glucometer ten minutes before intervention on the first day and about 15 minutes after the intervention on the third day and recorded in an observation sheet. A questionnaire also collected data on the general description of the respondents, including age, gender, educational level, and employment status.

Data on blood glucose before and after the intervention were analyzed using paired t-test with α=0,05. The data collection commenced after receiving ethical approval from Komisi Etik Penelitian Kesehatan (Health Research Ethic Commission) Poltekkes Kemenkes Mataram number LB.01.03/6/183/2024.

RESULTS

Table 1. Charactaristic of Respondents

Variables	Frequency	%
Age		
Early adulthood (26-35 years)	1	2.0
Late adulthood (36-45 years)	2	6.0
Early elderly (46-55 years)	20	29.0
Late elderly (56-65 years)	20	57.0
Upper seniors (> 65 years)	2	6.0

Variables	Frequency	%
Education Level		
Basic education (elementary and junior high school)	35	100.0
Employment status		
Working	5	14.0
Not working	30	86.0
Gender		
Women	35	100.0

Based on table 1, most respondents were at late elderly (56 - 65 years) age group (20 respondents; 57%). All of the respondents were women (100%) and graduated from elementary school (100%) and were not working (86%)

Table 2 Blood Glucose Before and After given Diabetic Exercise (n=35 respondents)

Blood Glucose	Pre test		Post test	
	n	%	n	%
141 <160	17	49	24	69
161 < 180	18	51	11	31
Mean	162.20		156.14	

Table 2 showed a decrease in the percentage of respondents with blood sugar level 161 < 180 from 51% on pretest to 31% on posttest. This means there was a decrease in blood glucose levels after receiving diabetic exercise.

Table 3. Results of paired T-test on Pre and Post Test Blood Glucose

Blood glucose	Mean	St. Deviation	p-value
Pre-test	6.1	2.1	0.000
post-test			

Table 3 showed the results of the paired T-test, show that the ρ value is $0.000 < \alpha = 0.05$

DISCUSSION

The research results found that the average blood glucose value before aerobic exercise was 162.20 mg/dl for 35 respondents (100%). This is caused by several factors such as age, gender, education and employment. Considering the respondents age which mostly aged 56-65 years (late elderly), it can be understood that the respondents have diabetes, might be due to the aging process. Aging can reduce insulin sensitivity so that it can affect blood glucose levels. The older you get, the higher the possibility of insulin resistance you have, where insulin is still produced but in insufficient quantities.[6] Another study showed that as people age, their metabolic processes begin to decrease, resulting in low insulin production, especially for those who rarely exercise.[7, 8]

Looking at the fact that all of the respondents were women. It can be explained why most diabetic people were women. This is because women have higher cholesterol than men, so women tend to be more at risk of developing diabetes mellitus.[9] This is supported by the physiological process that happens to women, that when menopause occurs, the insulin response decreases due to low estrogen and progesterone hormones.[9] Another influencing factor is women's body weight, which is often not ideal, so this is what makes women often suffer from diabetes. mellitus than men.[10] Women have a greater risk of suffering from type II diabetes mellitus than men, related to pregnancy, where pregnancy is a risk factor for diabetes mellitus.[10, 11]

The respondent's education level might impact motivation and awareness to prevent diabetes mellitus. Research showed a significant correlation between education level and the incidence of diabetes mellitus. A person with a low education level will have difficulty understanding the message or information they receive about diabetes.[12] People with a high level of education had a lower proportion of diabetes, with a dose-response pattern for all countries.[12] However, people with high educational levels have the potential to have diabetes because most of them usually work more in offices with little physical activity. In contrast, people with a low education level are likelier to be labourers or farmers with sufficient physical activity.[13] Someone who works has great benefits because blood glucose levels can be controlled through physical activity.

After doing diabetic exercise, the average blood sugar value decreased to 156.14 mg/dl. the Paired T-test, a ρ value of $0.000 < \alpha = 0.05$. This happened because of the respondents' compliance with the diabetic exercise provided; apart from that, aerobic exercise also lowered blood glucose levels due to comprehensive movement. During aerobic exercise, blood sugar decreases; during exercise, the muscles

contract and then relax, sugar will be used or burned for energy needs, and sugar will be transferred from the blood to the muscles during and after exercise.[14] Exercise is an activity that is beneficial for diabetes because it can lower blood sugar.[15] When exercising, the body needs energy, most of which is obtained from glucose. When exercising, there is an increase in energy requirements. In this way, there is also an increase in glucose use, so blood sugar decreases.[16]

Comprehensive movements in diabetic aerobic exercise only take approximately 20-25 minutes. This is a safe, low-impact exercise that elderly people can do.[17, 18] When exercising, the body needs energy, and most of this energy is obtained from glucose, so an increase in glucose use can decrease blood glucose level.[19, 20]

Despite the significant results of the effect of diabetic exercise on the decrease of blood glucose level, this study has not considered other confounding factors such as diet, the ability of the elderly to move, and the anti-diabetic drugs consumed by the respondents. Also, the small sample and the duration of the study, which only lasted a week, may bias the study result. Another study on this subject in the future should consider the length of time the intervention was given and the larger sample size.

CONCLUSION

It can be concluded that diabetic exercise performed 20-25 minutes three times a week can help reduce the blood glucose level of diabetic sufferers. This exercise is safe, low-impact, and can be performed by elderly diabetic patients. The movements in this exercise can increase the use of blood glucose and, therefore, reduce the blood glucose level. Health professional can include this exercise in the management of diabetic patients.

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