International Journal of Global Sustainable Research (IJGSR)
Vol.1, No.3, 2023: 441-452

The Effect of a Combination of Prolanis Exercises and Foot Exercises on Changes in Blood Glucose Levels in Type II Diabetes Mellitus Patients

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A R T I C L E I N F O
Keywords: Prolary Exercise, Foot Exercise, Glucose in the Blood, Type II Diabetes

Received : 12, September
Revised : 15, October
Accepted: 17, November

A B S T R A C T
Diabetes mellitus is still a global health problem as the number of suffering is still high all over the world. The recommended foot exercise for DM patients is aerobic foot exercise. To find out the effect of prolanic exercise and foot exercise on changes in blood glucose levels over time in patients with type II diabetes. The research design used in this study is a quasy experiment in the form of a two-group pretest and posttest design. The conclusions of this study have been obtained There is an influence of prolanic exercise and foot exercise on changes in blood glucose levels in patients with type II diabetes in Posyandu Manubar district of Reservoir.

INTRODUCTION

Diabetes mellitus is still a global health problem as the number of suffering is still high all over the world. Diabetes mellitus (DM) is a group of metabolic diseases characterized by hyperglycaemia that occurs due to insulin secretion abnormalities, insulin work or both. Approximately 90% of all cases of diabetes, the most common type of diabetes is type II DM (Adiputra et al., 2020).

The International Diabetes Federation (IDF) by 2021records 537 million adults (20-79 years of age) or 1 in 10 people living with diabetes worldwide. Diabetes also causes 6.7 million deaths, or one every five seconds. China is the country with the largest number of diabetic goddesses in the world. 140.87 million people in China live with diabetes by 2021. Next, India has 74.19 million diabetics, Pakistan 32.96 million, and the United States 32.22 million. Indonesia ranks fifth with 19.47 million. With a population of 179.72 million, this means that the prevalence of diabetes in Indonesia is 10.6% (Pahlevi, 2021).

Complications in DM sufferers, especially in adults and older people, usually occur due to uncontrolled blood sugar for a long time and due to a decrease in the body's endurance. Individuals with diabetes have a higher risk of developing disabilities and health problems than individuals without DM. Continuously high levels of glucose will result in serious diseases affecting the heart, blood vessels, eyes, kidneys and nerves. Individuals with diabetes will also have a high risk of developing infections. (ADA, 2017).

According to PERKENI, a good management of diabetes requires four main pillars: education, dietary planning, physical exercise, and pharmacological intervention. One of the wheels in the implementation of diabetes mellitus is the use of physical exercises. Diabetes mellitus is an exercise for diabetics whose emphasis is on rhythmic movements of muscles, joints, vascular and nerves in the form of stretching and relaxation. However, in its implementation many DM patients who still do not understand the importance of the implementation of DM gymnastics to prevent complications on his suffering. Some studies have shown that diabetic exercise can lower blood sugar levels and thus prevent complications and the severity of the disease. (Sugianto dan Sumarni, 2021).

Physical exercises performed at the right and correct doses can trigger processes of adaptation in the system, i.e. nervous system, hormones, cardiorespiration, metabolism, neuromusculoskeletal and body endurance. After physical exercise is done then for 10 minutes the need for glucose at the time will be increased up to 15 times the amount of the total requirement in the steady state. Exercises performed in patients with DM can result in increased glucose usage by active muscles, so that directly the exercise can lower blood sugar (Ilyas, 2015 dalam Hasfika, dkk. 2021).

The recommended foot exercises for patients with DM are aerobic foot exercise, which requires oxygen and can help improve blood circulation, strengthen the small muscles of the legs, prevent the occurrence of foot abnormalities that can increase the potential for diabetic wounds in the leg, and

increase the production of insulin used in transporting glucose to the cells, thereby helping to lower the glucosa in the blood. (Mangiwa et al., 2017).

According to Septriani, (2021) in his theory says that dynamic physical activity involving major muscle groups will increase oxygen intake by 15-20 times due to increased metabolic rate in active muscles. The pulmonary ventilation can reach 100 l/min and the heart rate increases to 20-30 L/min, to meet the needs of active muscles. Occurs restricted arterioles and capillaries that cause more open capillary networks so that the insulin receptors are more active and more sensitive (Hamzah et al., 2018) (Awaluddin & Sugiyanto, 2022).

Insulin receptor sensitivity lasts for a long time even until exercise is over. The active/insulin-sensitive muscle tissue is called non-insulin dependent tissue and the resting muscular tissue requires insulin to store glucose, so it is called insulin-dependent. In the post-exercise recovery phase, muscle and hepar glycogen reserves are rechargeable. Glycogenic activity continues until 12-24 hours after exercise, causing blood glucose to return to normal. (Damayanti, 2015).

The results of Sugianto and Sumarni study, (2021) on the influence of diabetic foot exercises on changes in blood sugar levels in patients with Type 2 Non-Ulkus DM found that in the pretest, respondents who had sugar levels >200 mg/dl prior to exercise were 15 people (100%). In the posttest, the respondents whose blood sugar level was 155-180 mg/dL was 11 people (73.3%) and who had blood glucose levels > 200 mg / dL were 4 people (26.7%) the age level was stable or rising. The results of statistical tests obtained a $p=0,001<\alpha=0,05$, it can be concluded that there is an influence of diabetic foot exercises on changes in blood sugar levels in patients with type 2 non-ulcerative DM. Hasfika, dkk. (2021) results obtained that the effect of prolanis exercise on blood sugar with a significance of 0.001. On blood pressure the result obtains there is an influence of prolenis exercises on changes in systolic blood pressure with a significantity of 0,000 and diastolic blood pressure with a meaning of 0.000. Data of patients with type 2 diabetes in Di Posyandu Manubar Department of Reserve during December 2022 of 26 people consisting of 20 women (77%) and 6 men (23%). The preliminary study conducted by the researchers on December 1 and 2 2022 found that in 10 people with diabetes mellitus type 2 performed blood glucose testing (GDS) obtained that as many as 8 people (80%) have GDS values between 200-300 mg/dl and as much as 2 people (20%) have a GDS value of more than 300 mg / dl. Treatment of type 2 diabetes sufferers by Puskesmas officers is an initiative to limit the consumption of high-sugar foods and drinks and a routine check-up to Posyandu.

Based on the above description, the researchers are interested in conducting a study entitled "The Effect of Combination of Prolanis and Leg Exercise on Blood Glucose Change During Type II Diabetes Patients in the East Kutai Reserve District of Posyandu Manubar District".

THEORETICAL REVIEW

Prolanis is a health service that is provided by the government through the BPJS Health and proactive approaches implemented in an overall and regular manner by involving participants suffering from chronic diseases to a healthier quality of life and prevent the emergence of complications with the cost of effective and effective services. (Idris 2018).

Blood glucose levels (in time) are influenced by factors such as physical activity, diet, drug use and stress. (Rudi 2018).

Foot exercise is an exercise that is performed for diabetics or non-diabetics to prevent the occurrence of injuries and to and to help launch blood clotting of the leg. (Setyoadi & Kushariyadi. 2018).

METHODOLOGY

The research project used in this research is a quasy experiment in the form of a design twogroup pretest and posttest Population in this study is the whole of patients with type II diabetes in Posyandu Manubar Prefecture of East Kutai district, with the method of sampling nonprobability samples purposive samplings techniques as many as 12 people intervention group and 12 people control group. Research instrument using GDS measuring instrument, observation sheet, SOP(Standar Operasional Prosedur).

The data obtained will be processed and the results will be displayed in a percentage of the frequency distribution table using the univariate analysis formula. Where univariate analysis is used to determine the characteristics of respondents as well as research variables. The data is then processed with the help of computerization using statistical tests. Where the bi-variation test in this study uses a Paired T-test with a thickness limit of α=0,05.

RESULTS

Univariat Analysis

Tabel 1. Karakteristik Responden pada Penelitian di Posyandu Manubar Kecamatan Sandaran Tahun 2023

Karakteristik	Kelompok Intervensi		Kelompok Kontrol	
	Frekuensi	%	Frekuensi	%
Umur				
30-40	0	0	3	25.0
41-50	2	16.7	4	33.3
51-60	10	83.3	5	41.7
Jenis Kelamin				
Laki-laki	5	41.7	0	0
Perempuan	7	58.3	12	100.0
Pendidikan				
Tidak Sekolah	2	16.7	3	25.0
SD	5	41.7	6	50.0
SMP	1	8.3	0	0
SMA	2	16.7	2	16.7
Perguruan Tinggi	2	16.7	1	8.3
Pekerjaan				
PNS	2	16.7	1	8.3
Wiraswasta	1	8.3	0	0
Petani	3	25.0	0	0

IRT	6	50.0	11	91.7
Lama Menderita DM				
1-5 tahun	4	33.3	8	66.7
Lebih 5 tahun	8	66.7	4	33.3
Karakteristik	Kelompok Intervensi		Kelompok Kontrol	
	Frekuensi	%	Frekuensi	%
Frekuensi Olahraga 1 Minggu				
Tidak ada	11	91.7	9	75.0
1-3 kali	1	8.3	3	25.0
Frekuensi Olahraga 1 Bulan				
Tidak ada	11	91.7	9	75.0
1-3 kali	1	8.3	3	25.0
Jenis Olahraga				
Tidak ada	11	91.7	9	75.0
Senam	1	8.3	3	25.0
Jenis Obat				
Glibenclamide	10	83.3	8	66.7
Metformin HCL	2	16.7	4	33.3
Dosis Obat				
Glibenclamide (1 x sehari)	10	83.3	8	66.7
Metformin HCL (3 x sehari)	2	16.7	4	33.3
Makanan Yang dikonsumsi (24 jam)				
Nasi	1	8.3	2	16.7
Nasi dan Sayur	4	33.3	3	25.0
Nasi, Sayur dan Lauk	7	58.3	7	58.3

Based on table 1, it is known that the age characteristics of the intervention group were mostly aged 51-60, 10 people (83.3%) and the control group, mostly aged 51-60, 5 people (41.7%). In the intervention and control groups, 5 people had elementary school education (41.7%) and 6 people had elementary school education (50%). The intervention group mostly worked as housewives, 6 people (50%). Meanwhile, in the control group, the majority of housewives' work was 11 people (91.7%). The intervention group mostly suffered from DM for more than 5 years as many as 8 people (66.7%), while in the control group, the majority suffered from DM for more than 1-5 years as many as 8 people 66.7%). In the intervention group, 11 people (91.7%) did not have 1 week exercise frequency, while in the control group, 1 week exercise frequency was missing, 9 people (75%). In the intervention group, most types of exercise were absent as many as 11 people (91.7%), while in the control group, most types of exercise were absent as many as 9 people (75%). The intervention group mostly had glibenclamide medication, 10 people (83.3%), while in the control group, 8 people (66.7%) had the majority of glibenclamide medication. The intervention group had the majority of the dose of glibenclamide medication (1 x a day) as many as 10 people, 83.3%), while in the control group, the majority of the dose of glibenclamide medication (1 x a day) was 8 people (66.7%). In the intervention group, the majority of food consumed

(24 hours) was rice, vegetables and side dishes, 7 people (58.3%), while in the control group, the majority of food consumed (24 hours) was rice, vegetables and side dishes, 7 people (58 .3%).

Table 2. Blood glucose levels of respondents of intervention groups on research in Posyandu Manubar district of Reserve 2023 (n=12)

Kelompok Intervensi	Mean	Median	Standar Deviasi	Nilai Minimum	Nilai Maksimum	n
Sebelum	362,08	357,50	44,755	302	472	12
Sesudah	290	290	32,677	246	347	12

Based on table 2, it is known that the blood glucose levels of respondents in the intervention group before being given prolanis exercises and leg exercises, namely the mean blood glucose level value was 362.08 mg/dl, the median was 357.50 mg/dl, the minimum value was 302 mg/gl, maximum value 472 mg/dl and standard deviation 44.755 mg/dl. Meanwhile, the blood glucose levels of intervention group respondents after being given prolanis exercises and leg exercises were the mean blood glucose level was 290 mg/dl ml, the median was 290 mg/dl, the minimum value was 246 mg/dl, the maximum value was 347 mg/dl and standard deviation 32.677 mg/dl.

Table 3. Control Group Blood Glucose Levels in Research at Posyandu Manubar, Sandaran District in 2023 (n=12)

Kelompok Intervensi	Mean	Median	Standar Deviasi	Nilai Minimum	Nilai Maksimum	n
Sebelum	290,75	302	55,159	206	380	12
Sesudah	257.17	256,50	40,588	189	335	12

Based on table 3, it is known that the blood glucose levels of control group respondents before being given prolanis exercise were the mean blood glucose level value was 290.75 mg/dl, the median was 302 mg/dl, the minimum value was 206 ml, the maximum value was 380 ml and the standard deviation 55.159 mg/dl. Meanwhile, the control group's blood glucose levels after being given leg exercises were the mean blood glucose level was 257.17 mg/dl, the median was 256.50 mg/dl, the minimum value was 189 mg/dl, the maximum value was 335 mg/dl and the standard deviation 40.588 mg/dl.

Bivariate Analysis

Table 4. Differences in Blood Glucose Levels Before and After the Intervention Group and the Control Group at Posyandu Manubar, Sandaran District in 2023 (n=12)

Kelompok	Glukosa	n	Mean	Standar Deviasi	Beda Mean	nilai -p
	Sebelum	12	362.08	44.755	72.083	

Intervensi	Sesudah	12	290	32.677		0,000
	Sebelum	12	290.75	55.159	33.583	
Kontrol	Sesudah	12	257.17	40.588		0,000

Uji *Paired T-Test*

Based on the results of the analysis in table 4, it was found that the difference in blood glucose levels before and after being given prolanis exercises and leg exercises was (72.083 mg/dl), which means that there was a decrease in blood glucose levels after being given prolanis exercises and leg exercises. The statistical test results showed a p-value of 0.000 (p<0.05), which means there was a significant difference in the average blood glucose levels before and after being given prolanis exercises and leg exercises in the intervention group.

Then it was also obtained that the difference in blood glucose levels before and after being given prolanis exercises was (33.583 mg/dl), which means that there was a decrease in blood glucose levels after being given leg exercises. The statistical test results showed a p-value of 0.000 (p < 0.05), which means there was a significant difference in the average blood glucose levels before and after being given prolanis exercises in the control group.

Table 5. The Effect of a Combination of Prolanis Exercises and Foot Exercises on Changes in Blood Glucose Levels in Type II Diabetes Mellitus Patients at Posyandu Manubar, Sandaran District

Variabel	**Kelompok**	**n**	**Mean**	**Standar Deviasi**	**Beda Mean**	**nilai -p**
Kadar Glukosa Darah	Intervensi (senam prolanis dan senam kaki)	12	290.000	32.677	23.833	0,040
	Kontrol (senam prolanis)	12	257.17	40.588		

Based on the analysis results in table 5. The average blood glucose level value obtained in the prolanis exercise and leg exercise intervention group was a mean of 290 mg/dl with a standard deviation of 32.677 mg/dl, while the average blood glucose level value after administering prolanis exercise in the control group was 257.17 mg. /dl, with a standard deviation of 40.588 mg/dl. The difference in blood glucose levels in the intervention group with the provision of prolanis exercises and leg exercises compared to the control group with prolanis exercises was 32.833 mg/dl, which means that the average value of blood glucose levels in the intervention group with the provision of prolanis exercises and leg exercises was higher than the control group. by giving prolanis exercises. The statistical test results obtained a p-value of 0.040 (p<0.05), which means that there is an influence of prolanis exercise and leg exercises on

changes in blood glucose levels in patients with type II diabetes mellitus at Posyandu Manubar, Sandaran District.

DISCUSSION

Based on the results of the analysis, the average value of blood glucose levels in the prolanis exercise and foot exercise intervention group was a mean of 290 mg/dl with a standard deviation of 32.677 mg/dl, while the average value of blood glucose levels after giving foot exercises in the control group was 257 .17 mg/dl, with a standard deviation of 40.5887 mg/dl. The difference in blood glucose levels in the intervention group with the provision of prolanis exercises and leg exercises compared to the control group with prolanis exercises was 32.833 mg/dl, which means that the average value of blood glucose levels in the intervention group with the provision of prolanis exercises and leg exercises was higher than the control group. by giving prolanis exercises. The results of statistical tests obtained a p-value of 0.040 ($p<0.05$), which means that there is an influence of the combination of prolanis exercise and leg exercise on changes in blood glucose levels in patients with type II diabetes mellitus at Posyandu Manubar.

These results are in line with the results of previous research according to Hasfika, et al. (2021) found that there was an effect of prolanis exercise on changes in blood sugar levels. The results of Yulianti and January's research (2021) showed that there was an effect of leg exercises on changes in blood sugar levels in type 2 DM sufferers.

Dynamic physical activity involving major muscle groups will increase oxygen uptake by 15-20 times due to an increase in the metabolic rate in active muscles. Pulmonary ventilation can reach 100 L/minute and cardiac output increases to 20-30 L/minute, to meet the needs of active muscles. Dilatation of arterioles and capillaries occurs which causes more capillary beds to open so that there are more insulin receptors and they are more active/more sensitive (Hamzah et al., 2018) (Awaluddin & Sugiyanto, 2022).

Insulin receptor sensitivity persists even after exercise has ended. Muscle tissue that is active/insulin sensitive is called non-insulin dependent tissue and muscle tissue at rest requires insulin to store glucose, so it is called insulin dependent tissue. In the post-exercise recovery phase, muscle and liver glycogen reserves are replenished. Glycogenic activity continues for 12-24 hours post exercise, causing blood glucose to return to normal (Damayanti, 2015).

The management of physical activity for DM sufferers is generally the same as the general principles of exercise, namely fulfilling the following, including frequency, intensity, time or duration, and type or type of exercise. For diabetes sufferers, the physical activity chosen should be a sport that is enjoyed, and which the diabetic sufferer is likely to be able to do. The exercise you do should involve large muscles and be consistent with your wishes so that the benefits of exercise can be felt continuously. This exercise must be done regularly.

Researchers assume that there is an influence of the combination of prolanis exercise and leg exercises on changes in blood glucose levels in type II

diabetes mellitus patients due to physical activity factors which can influence blood glucose levels. Physical activity is a movement resulting from skeletal muscle contractions that requires energy exceeding energy expenditure during rest. During exercise, muscles become more active, where there will be an increase in membrane permeability and an increase in blood flow, as a result, more capillary membranes are open and more insulin receptors are active, there is a shift in energy use by muscles from fatty acid sources to the use of glucose and muscle glycogen. .

Food or diet factors are also the main factors associated with increasing blood glucose levels, especially after eating. Blood glucose levels are also influenced by the use of oral hypoglycemia drugs or insulin. The mechanism of action of drugs to reduce blood glucose levels includes stimulating the pancreatic gland to increase insulin production, reducing glucose production in the liver, and inhibiting carbohydrate digestion so that it can reduce glucose absorption and stimulate receptors.

Glucose or also called blood sugar is a monosaccharide and primary metabolite for energy production in the body in the form of ATP. When exercising, sufficient energy is needed so that glucose is broken down into ATP which results in reduced blood sugar levels in the body (Wulandari, 2018).

CONCLUSIONS AND RECOMMENDATIONS

Based on the discussion and description, the conclusion is that there is an effect of a combination of prolanis exercise and foot exercise on changes in blood glucose levels in type II diabetes mellitus patients at Posyandu Manubar, Sandaran District.

It is hoped that the results of this study will pay more attention to prolanis exercise and foot exercise activities which effectively influence changes in blood glucose levels in patients with type II diabetes mellitus. Complementary therapy activities such as prolanis exercise and leg exercises are used as one of the interventions at the Community Health Center which effectively influences changes in blood glucose levels in patients with type II diabetes mellitus.

FURTHER STUDY

As for suggestions that can be given to future researchers, it is hoped that this research can continue by using other types of complementary therapy which can also influence changes in blood glucose levels in type II diabetes mellitus patients.

ACKNOWLEDGMENT

This article was made possible by guidance, direction and assistance from various parties that the author cannot mention one by one and on this occasion the author would like to express his thanks to all parties involved and providing support. The author apologizes for any shortcomings. Hopefully this article can provide benefits to encourage further research.

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