Original Research

The Effect Of Progressive Muscle Relaxation Techniques On Blood Glucose Levels In Elderly With Type 2 Diabetes Mellitus

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ABSTRACT

Introduction: The International Diabetes Federation revealed that Indonesia is currently ranked sixth worldwide for deaths from diabetes in 2021. In addition to pharmacological therapy, managing type 2 diabetes mellitus can use non-pharmacological therapies, such as progressive muscle relaxation therapy. This study aimed to analyze the effect of progressive muscle relaxation therapy on blood glucose levels in older people with type 2 diabetes mellitus.

Methods: This study used a quantitative method with a quasi-experimental approach, pre-test, and post-test with a control group. Sampling technique random was applied and yielded 70 participants. Data was collected through observation sheet of blood glucose levels and Progressive Muscle Relaxation (PMR) standard operating procedure. Data analysis using the T-Test.

Results: The average blood glucose level before the intervention was 211.7 mg/dl and 183.74 mg/dl after the intervention. In the intervention group, there was an effect with p-value = 0.036 (p-value <0.05). Post-intervention and post-control, there was no difference with a value of 0.074 (p> 0.05), meaning there is no difference.

Conclusions: The progressive muscle relaxation is effective to reduce blood sugar levels of elderly with type 2 diabetes. The exercise help elderly to improve the glucose metabolism process by way burned the calories, shifted into energy, and maintained the normal level of blood glucose.

1. INTRODUCTION

A chronic condition called diabetes mellitus (DM) is characterized by blood glucose levels that are consistently higher than usual (Kementrian Kesehatan RI, 2020). The World Health Organization (WHO) defines diabetes mellitus as a group of metabolic disorders characterized by high blood glucose levels or hyperglycemia, as well as disturbances of carbohydrate, fat, and protein metabolism caused by problems with insulin production and insufficient insulin action. According to the American Diabetes Association (2022) diabetes is the leading cause of 6.7 million deaths worldwide, or one every five seconds.

According to the International Diabetes Federation (2021) 537 million adults aged 20 to 79, or 1 in 10 people, were living with diabetes worldwide. Indonesia is currently ranked sixth in the world, with the number of deaths from diabetes reaching 236 thousand people in 2021. According to the East Java Provincial Health Office, in 2020, there

were 875,745 people with Diabetes Mellitus in East Java (Kementrian Kesehatan RI, 2020). Gresik City contributed 43,539 people with Diabetes Mellitus. In the era of the COVID-19 pandemic caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) and which has infected more than 6 million people in Indonesia, diabetes mellitus is one of the main comorbid components of COVID-19 which is often discussed. Pre-existing diseases or what we call co-morbidities can increase the severity of COVID-19 (Sisman et al., 2022). There are several comorbidities from COVID-19 such as Diabetes Mellitus, Asthma, Hypertension, and so on. Diabetes Mellitus is the number one comorbid or comorbid disease in cases of COVID-19 death in Indonesia. According to data taken from the official website of the COVID-19 Task Force as of May 31, 2022, there were 155,509 cases of COVID-19 death in Indonesia, and of the 6,203 cases of COVID-19 sampled, 9.4% had comorbid Diabetes Mellitus due to high levels of mortality tripled, with a ratio of 7.3% and 2.3% when compared to people without Diabetes Mellitus (Ratnawati et al., 2019).

Several studies related to diabetes mellitus at the end of the pandemic gave the result that people who recovered from COVID-19 had a higher risk of developing type 2 diabetes, so recently it was said that the world was starting to grapple with a double pandemic, namely diabetes and coronavirus disease 2019 (COVID-19). COVID-19 confers an increased risk of type 2 diabetes based on the conclusions drawn from Wolfgang Rathmann's research. The study also addressed primary care demonstrating a temporal link between mostly mild COVID-19 and newly diagnosed type 2 diabetes. If confirmed, this study supports the potential relevance of active monitoring of glucose dysregulation after recovery from a mild form of SARS-CoV-2 infection. An analysis of the health records of 1,171 general and internal medicine practices across Germany conducted by Professor Wolfgang Rathmann and Professor Oliver Kuss of the German Diabetes Center at Heinrich Heine University, Dusseldorf, Germany, and Professor Karel Kostev (IQVIA, Frankfurt, Germany) found that adults who recover from COVID-19 appear to have a higher risk of developing type 2 diabetes than a control group who have other types of respiratory infections, which are also often caused by viruses (Sisman et al., 2022).

The data and information center of the Indonesian Ministry of Health, known as Info DATIN, discusses how to treat diabetes mellitus. Management of diabetes mellitus cases according to the 2020 DATIN Info, is divided into three parts: temporary goals, long-term goals, and definitive management goals to reduce morbidity and mortality. Diabetes mellitus is a disease that can be treated with two treatments, specifically synthetic drugs such as oral hypoglycemic drugs (OHO), insulin, as well as chemical and herbal medicines (Kementrian Kesehatan RI, 2020).

The four main pillars of DM include education, physical activity, pharmacy, nutritional therapy, and non-pharmacological therapy. They are renowned for avoiding the diseases and problems associated with type 2 DM. Monitoring a patient's hydration status and encouraging them to drink more fluids are two nursing care strategies that nurses can use to treat hyperglycemia. One of them is using progressive muscle relaxation techniques for non-pharmacological treatment. The involvement of nurses in teaching relaxation methods is very important. During the use of progressive muscle relaxation techniques, the nurse's roles are assigned in a specific sequence that includes not only performing the procedure correctly but also preparing the patient mentally and working with the patient's family (Utama, 2021).

Everyone can benefit from using progressive muscle relaxation in a variety of conditions and illnesses, especially people with type 2 DM. One of the actions that can lower blood glucose levels, especially in diabetics, is progressive muscle relaxation. This is because the release of certain hormones, such as epinephrine, cortisol, glucagon, adrenocorticotropic hormone (ACHT), corticosterone, and thyroid hormone, is suppressed. When a person is calm and relaxed, the sympathetic nervous system plays an important role. When a person is calm and relaxed, the sympathetic nervous system causes the hypothalamus to inhibit the release of corticotropin-releasing hormone (CRH).

Adenohypophysis will be affected by a decrease in CRH, which will cause less competition for adrenocorticotropic hormone (ACHT) which is circulated to the adrenal cortex (Karokaro & Riduan, 2019). According to Jacobson, progressive muscle relaxation can increase the body's capacity to utilize oxygen, speed up breathing, reduce muscle tension, increase metabolism, control systolic and diastolic blood pressure, and increase alpha brain waves.

According to nurses and midwives in Singosari Village, Kebomas District, Gresik City, for the management of type II diabetes, progressive muscle relaxation interventions are not carried out by nurses as a substitute for type II DM patients to meet their needs for physical activity or exercise . Based on the background above, the researchers are interested in researching the effect of Progressive Muscle Relaxation Therapy on reducing blood glucose levels in the elderly with type 2 diabetes mellitus.

2. MATERIALS AND METHOD

2.1 Design
This study uses a quantitative method with a quasi-experimental approach where we look at the pre-test and post-test with a control group and an intervention group. In this study, the researchers treated the independent variable, namely Progressive Muscle Relaxation (PMR) in the experimental group and saw the effect on the dependent variable.

2.2 Population, Sample, and Sampling
The population is a speculative area that combines items or subjects that have certain

characteristics and qualities that are determined by scientists to focus on and then end (Sugiyono, 2018). The population in this study were the elderly with type 2 DM in the community setting, namely Singosari Village, Kebomas District, Gresik City in July - August as many as 84 registered elderly.

The sample is a small part of the number and type of population. The sample size is the level for taking large samples taken in a study (Sugiyono, 2018). The number of samples taken from the population in this study was several elderly people in the Singosari Village, Kebomas District, Gresik City with Type 2 Diabetes Mellitus, according to the research criteria, 70 elderly people.

Sampling in this study used random sampling and randomized again to determine the control group and the intervention group for respondents. Random sampling is a way of taking samples by using checking the state of the population list (population framework) to determine the interval range. 35 elderly people entered the control group and 35 other people entered the intervention group.

2.3 Variable

d. Wipe the tip of the finger with an alcohol swab or cotton that has been added with alcohol to clean the area to be stabbed
e. Prick the tip of the finger with a lancet so that the blood can come out and can be collected
f. Place a drop of blood on the drip strip and wait for the result, after waiting a few seconds on the meter/ glucometer layer
g. After that, attach the alcohol swab back to stop the blood from coming out.
2) Observation sheet
The observation sheet was used to record the study code, study period, date of examination, and results of measuring blood glucose levels before and after intervention with progressive muscle relaxation techniques.
3) Mat
This mat is used as a base in the implementation of progressive muscle relaxation therapy.
4) Standard operating procedure (SOP) for Progressive Muscle Relaxation Therapy
According to Wijayati, S., Jauhar, M., Widiyati, S., & Faikha (2021), the procedure for

Table 1. Variable and Definition Operational

Variable	Definition Operational	Parameter	Measuring Instrument	Scale	Measuring Results
Progressive Muscle Relaxation Therapy	One of the nursing interventions that can help DM patients is muscle exercise.	Standard Operating Procedur (SOP)	Checklist	-	-
Blood glucose levels	Blood glucose level is a term that refers to the level of glucose in the blood whose concentration is tightly regulated by the blood	mg/dl	Glukometer	Intervals	The value of blood glucose levels in the body decreases

2.4 Instruments

In this study, there are factors, which have qualities that need to be realized which should be possible by making moving estimates. To find out the properties of a variable, an estimator called an instrument is needed (Sugiyono, 2018). In this study there are several instruments, in particular:
1) Glucometer
The instrument used is a measuring device for blood glucose levels at any time. The measurement results are in the form of ratio data (current blood glucose levels in units of mg/dl). To measure blood glucose levels in the body, the Easy Touch Brand Glucometer is used. Techniques for measuring blood glucose levels in the body with a glucometer:
a. First prepare equipment and wash hands with soap and running water
b. Place the lancet that has been opened into the lancing device.
c. Insert the test strip into the glucose meter or glucometer

administering progressive muscle relaxation therapy is as follows:
a. Build a relationship of mutual trust, and explain the procedure, and the goals of therapy to the patient.
b. Equipment and environment preparation: chairs, pillows, and a calm and quiet environment.
c. Position the patient lying down or sitting in a chair with the head supported.
d. Client preparation:
a) Explain the purpose, benefits, and procedures and fill out the therapy consent form to the client.
b) Position the client's body comfortably, namely lying down with eyes closed using a pillow under the head and knees or sitting in a chair with the head supported,
c) Remove used accessories such as glasses, clocks, and shoes.

d) Loosen ties, belts, or other things that are tightly binding.

e. Applying progressive muscle relaxation twice a week with 30 minutes in one session

f. Continue by two weeks implementation of progressive muscle relaxation

2.5 Procedure

This research was conducted for 2 weeks with four meetings divided into two groups, namely the intervention group and the control group. Meetings are held twice a week on Saturday and Thursday which are held at the elderly Posyandu, Singosari sub-district, Kebomas sub-district, Gresik city. As long as they are respondents, they are required to continue taking oral hyperglycemic drugs (OHO) in both the intervention and control groups. Taking blood glucose levels with (GDP) fasting blood glucose. Before the meeting the researcher will tell the respondent to fast before the measurement, fasting 7 hours before the examination. If the respondent did not fast before the measurement, then the respondent was excluded and the number of samples was changed with a ratio of 1:1. Before providing interventions in progressive muscle relaxation therapy techniques, the researcher will explain relaxation techniques and inform the rights and obligations of the respondents. Before doing the relaxation technique the respondent will check his blood sugar level and after doing the relaxation technique the results will be pre and post-material.

2.6 Data Analysis

This research was conducted for 2 weeks with four meetings divided into two groups, namely the intervention group and the control group. Meetings are held twice a week on Saturday and Thursday which are held at the elderly Posyandu, Singosari sub-district, Kebomas sub-district, Gresik city. As long as they are respondents, they are required to continue taking oral hyperglycemic drugs (OHO) in both the intervention and control groups. Taking blood glucose levels with (GDP) fasting blood glucose. Before the meeting the researcher will tell the respondent to fast before the measurement, fasting 7 hours before the examination. If the respondent did not fast before the measurement, then the respondent was excluded and the number of samples was changed with a ratio of 1:1. Before providing interventions in progressive muscle relaxation therapy techniques, the researcher will explain relaxation techniques and inform the rights and obligations of the respondents. Before doing the relaxation technique the respondent will check his blood sugar level and after doing the relaxation technique the results will be pre and post-material.

2.7 Ethical Clearance

1) Informed Consent

Respondents have the choice to opt-in or avoid the review. After receiving clarification from the Education Assent regarding the examination including exploration techniques, benefits, and dangers. Respondents are offered the opportunity to give an Informed Agree to take the exam. Respondents may withdraw from the review without success.

2) Anonymity

Researchers are required to maintain the confidentiality of the identity of the elderly only for research purposes. In writing the data that will be written by the researcher using the respondent's code.

3) Confidentiality

The analyst follows the classification of the information obtained from the respondents and does not give it to anyone else. This rule is implemented by removing the first personality such as the respondent's name and replacing it with the respondent's code. The consequences of mixed information are known only to specialists. Options for approaching treatment continue to be looked at in this review.

3. RESULTS

The results of the above study (Table 2) showed that 59 elderly women were female with a total of 70 elderly respondents so a percentage of 84.29% was obtained in the total group. So this can justify Soegondo's statement in 2018, that gender can affect blood glucose levels. The conclusion from this study is that there is a relationship between the female gender and blood glucose levels (Soegondo, S., Soewondo, P., & Subekti, 2018). The duration of disease diagnosis of 6-10 years was 45.71% for 32 of the 70 elderly.

Table 3 presents the results of blood glucose levels in the elderly with type 2 diabetes mellitus before and after intervention in progressive muscle relaxation therapy. We can see from the table above that the difference in blood glucose levels in the intervention group before and after being given the progressive muscle relaxation therapy intervention resulted in an average decrease of 27.96 mg/dl. Meanwhile, the control group produced an average increase of 3.98 mg/dl. Furthermore, researchers tested the effect of progressive muscle relaxation therapy using the t-test. The intervention group made P=0.036, which means that progressive muscle.

4. DISCUSSION

The average blood glucose level in the elderly before being in the control group was 207.51 mg/dl with the lowest blood glucose level of 150 mg/dl and the highest blood glucose level of 375 mg/dl with a standard deviation of 58.034. In the intervention group, the average blood glucose level before the relaxation therapy affected blood glucose levels in the elderly with type 2 diabetes mellitus, while the control group produced P=0.117. The researcher also

Table 2. Demographic Characteristics Age, gender, duration of DM, drug consumption, and health history of elderly DM type 2 at the elderly Posyandu, Singosari sub-district, Gresik, December (n=70)

Characteristics	n	%
Years		
Intervention		
60-65	22	67,08
66-70	3	9,92
71-75	6	11,4
76-80	2	5,8
81-85	2	5,8
Control		
60-65	20	62,7
66-70	6	11,4
71-75	5	14,3
76-80	2	5,8
81-85	2	5,8
Gender		
Intervention		
Female	29	
Male	6	
Control		
Female	30	
Male	5	
Long Suffered		
Intervention		
1-5　Years	12	34,4
6-10　Years	16	45,7
11-15 Years	5	14,2
16-20 Years	2	5,7
Control		
1-5　Years	12	34,4
6-10　Years	16	45,7
11-15 Years	5	14,2
16-20 Years	2	5,7
DM Family History		
Intervention		
Yes, have Family with DM	25	71,4
No DM	10	28,6
Control		
Yes, have Family with DM	26	74,3
No DM	9	25,7
Drug consumption (OHO)		
Intervention		
Yes, consumption OHO	35	100
No consumption OHO		
Control		
Yes, consumption OHO	35	100
No consumption OHO		
Routine drug consumption (OHO)		
Yes, routine consumption		100
No routine consumption		

conducted a different test using the independent t-test, which had a value of 2-tailed = 0.074, which means that there was no difference between the control and intervention groupsintervention of progressive muscle relaxation therapy was 211.71 mg/dl with the lowest blood glucose level of 150 mg/dl and the highest at 478 mg/dl with a standard deviation of 75.316. According to researchers, lifestyle and environmental factors play an important role in health, especially blood glucose levels. In this Singosari sub-district which is an area flanked by large factories, pollution has an important role in influencing health and blood glucose levels in the elderly.

Polyuria, polydipsia, polyphagia, and unexplained weight loss are all possible symptoms of DM (Patimah, I., Widadi, S. Y., & Riyadi, 2021). Among other things, other DM patients may complain of

Table 3 Blood Glucose Levels of elderly DM type 2 at the elderly Posyandu, Singosari sub-district, Gresik, December (n=70)

Blood Glucose Levels		
Variable	Mean	SD
Before		
Intervention	211,71 mg/dl	75,316
Control	207,51 mg/dl	58,034
After		
Intervention	183,74 mg/dl	67,776
Control	211,49 mg/dl	59,32

fatigue, weakness, tingling in the hands or feet, itching, susceptibility to bacterial or fungal infections, poor wound healing, and blurred vision. However, sometimes DM patients do not show any symptoms (Febrinasari Puspita Ratih, 2020). According to researchers, the symptoms that arise in patients with type 2 diabetes mellitus depend on internal and external factors. Internal factors, namely from the psychic or mind and physical of the sufferer. External factors, namely environmental and social, the environment itself can be divided into a family environment or a residential environment.

Excess blood glucose levels in the body or hyperglycemia are glucose levels in the blood that exceed normal limits. Hyperglycemia is when the fasting blood glucose level is more or equal to 126 mg/dl. Blood glucose levels are affected by age, physical activity, gender, heredity, and diet (Soegondo, S., Soewondo, P., & Subekti, 2018). According to current study, gender can also be a risk factor for high blood glucose levels. From the results of the above study, most elderly people with diabetes mellitus are female.

The average blood glucose level in the elderly after being in the control group was 211.49 mg/dl with the lowest blood glucose level value of 157 mg/dl and the highest blood glucose level of 352 mg/dl. In the progressive muscle relaxation therapy intervention group in elderly people with type 2 diabetes mellitus at the elderly Posyandu in Singosari village, it was 183.74 mg/dl with the lowest blood glucose level of 117 mg/dl and the highest blood glucose level of 379 mg/dl. This study underlined progressive muscle relaxation therapy has an effect on decreasing blood glucose levels in the elderly with type 2 DM. The decrease that occurs after progressive muscle relaxation therapy is the result of non-pharmacological treatment that can be done every day at home independently (Kusnanto et al., 2019). PMR resulted muscles relaxation and relieved tension which increases the alpha brain waves that occur in elderly (Akbar, M. A., Malini, H., & Afriyanti, (2018); Avianti, N., Desmaniarti, Z., & Rumahorbo (2016)). Blood glucose before and after the progressive muscle relaxation therapy intervention, in the control group there was an average increase with a difference of 3.98 mg/dl. It is also known from that the difference in the mean decrease in blood glucose levels in the intervention group before and after being

given intervention in the form of progressive muscle relaxation therapy was 27.96 mg/dl.

The difference in the value of blood glucose levels in the elderly with type 2 diabetes mellitus at the elderly Posyandu in Singosari village in the control group was 35 people according to table 5.8, the control showed an average increase with a difference of 3.98 mg/dl. It is also known from table 5.8 that the difference in the mean decrease in blood glucose levels in the intervention group before and after being given intervention in the form of progressive muscle relaxation therapy was 27.96 mg/dl. The results also show that blood glucose levels before and after using the information test T-Test with regularity value of importance are less than 0.05 (p <0.05). In the control group, there was no effect with an importance value of p = 0.117 (p value> 0.05), which means there was no influence. In the intervention group, the effect of progressive muscle relaxation therapy was seen with a p-value = 0.036 (p-value <0.05).

Blood glucose levels in the elderly after being given intervention and without giving intervention means that the second data is the same or homogeneous with a sig value of 0.880 (p> 0.05). Based on the table above, we can see that there was no significant difference between the intervention group and the control group with a sig. (2-tiled) of 0.07 (p>0.05). This might relate to other factors that did not examine by researchers such as diet and other physical activity. Therefore, further study involved more elderly with DM type two treated by PMR is warranted.

5. CONCLUSION

Prior to the progressive muscle relaxation therapy intervention, the average blood glucose level was 211.71 mg/dl. After the intervention of progressive muscle relaxation therapy, the average blood glucose level was 183.74 mg/dl. There is an effect of decreasing blood glucose levels with a value of 0.036 or <0.05, which means that Ha is accepted, and H_0 is rejected.

Based on the results of the analysis during the study, decreased blood glucose levels can also be caused by psychological and environmental factors. Environmental factors in the form of a clean research area, while the psychological factors of the

respondent indicated that he can calm down while doing progressive muscle relaxation therapy and can talk between the elderly with one another. The exercise help elderly to improve the glucose metabolism process by way burned the calories, shifted into energy, and maintained the normal level of blood glucose.

6. REFERENCES

Akbar, M. A., Malini, H., & Afriyanti, E. (2018). Progressive muscle relaxation in reducing blood glucose level among patients with type 2 diabetes. *Jurnal Keperawatan Soedirman*, *13*(2), 77–83.

American Diabetes Association. (2022). Diabetes Technology : Standards of Medical Care in Diabetes — 2022. *Diabetes Care*, *45*(1), 597–5112.

Avianti, N., Desmaniarti, Z., & Rumahorbo, H. (2016). Progressive muscle relaxation effectiveness of the blood sugar patients with type 2 diabetes. *Open Journal of Nursing*, *6*(3), 248–254.

Febrinasari Puspita Ratih, et al. (2020). *Buku Saku Diabetes Melitus Untuk Awam* (Cetakan 1). UNS Press.

International Diabetes Federation. (2021). IDF Diabetes Atlas. In *Diabetes Research and Clinical Practice*. https://doi.org/10.1016/j.diabres.2013.10.013

Karokaro, T. M., & Riduan, M. (2019). Pengaruh Teknik Relaksasi Otot Progresif terhadap Penurunan Kadar Gula Darah pada Pasien Diabetes Mellitus Tipe 2 di Rumah Sakit Grandmed Lubuk Pakam. *Jurnal Keperawatan dan FisioterapI (JKF)*, *1*(2), 48–53. https://doi.org/10.35451/jkf.v1i2.169

Kementrian Kesehatan RI. (2020). *Infodatin tetap produktif, cegah, dan atasi Diabetes Melitus 2020*. Pusat Data dan Informasi Kementerian Kesehatan RI.

Kusnanto, K., Murtadho, M. A., Herawati, L., & Arifin, H. (2019). The Comparison of Progressive Muscle Relaxation Frequency on Anxiety, Blood Pressure, and Pulse of Haemodialysis Patients. *Jurnal Ners*, *14*(1), 69–74. https://doi.org/10.20473/jn.v14i1.15700

Patimah, I., Widadi, S. Y., & Riyadi, M. A. (2021). Associations diabetes knowledge and glycemic control among diabetes mellitus patients in Garut District, Indonesia. *Age*, *50*(50), 27.

Ratnawati, D., Wahyudi, C. T., & Zetira, G. (2019). Dukungan Keluarga Berpengaruh Kualitas Hidup Pada Lansia dengan Diagnosa Diabetes Melitus. *Jurnal Ilmiah Ilmu Keperawatan Indonesia*, *9*(02), 585–593. https://doi.org/10.33221/jiiki.v9i02.229

Riwidikdo, H. (2012). *Statistik Kesehatan*. Mitra Cendekia.

Sisman, P., Polat, I., Aydemir, E., Karsi, R., Gul, O. O., Cander, S., Ersoy, C., & Erturk, E. (2022). How the COVID-19 outbreak affected patients with diabetes mellitus? *International Journal of Diabetes in Developing Countries*, *42*(1), 53–61. https://doi.org/10.1007/s13410-021-00992-y

Soegondo, S., Soewondo, P., & Subekti, I. (2018). *Penatalaksanaan Diabetes Mellitus Terpadu*. Balai Penerbit FKUI.

Sugiyono. (2018). *Metode Penelitian Kuantitatif*. Alfabeta.

Utama, H. (2021). Pengaruh Terapi Relaksasi Tehadap Penurunan Kadar Gula Darah Pasien Diabetes Melitu Tipe 2. *Jurnal Keperawatan*.

Wijayati, S., Jauhar, M., Widiyati, S., & Faikha, S. (2021). Combination Of Autogenic And Progressive Muscle Relaxation To Reduce Blood Pressure Among Elderly With Hypertension In A Nursing Home. *Annals of Tropical Medicine and Public Health*, *7*(3), 8–14.

World Health Organization. (2023). *Diabetes*. https://www.who.int/health-topics/diabetes#tab=tab_1