Indonesian Journal of Global Health Research
Volume 6 Number S6, December 2024
e-ISSN 2715-1972; p-ISSN 2714-9749
http://jurnal.globalhealthsciencegroup.com/index.php/IJGHR

EFFECT OF PROGRESSIVE MUSCLE RELAXATION ON STRESS AND BLOOD SUGAR IN DIABETES MELLITUS PATIENTS

Ika Mustafida*, Fitrian Rayasari , Dewi Anggraini, Wati Jumaiyah
Faculty of Nursing, Universitas Muhammadiyah Jakarta, Jl. K.H. Ahmad Dahlan, Cireundeu, Tangerang Selatan, Banten 15419, Indonesia
*ikamustafida@gmail.com

ABSTRACT
Diabetes Mellitus is a chronic condition characterized by impaired insulin production, leading to hyperglycemia. Physically and psychologically, Diabetes Mellitus can cause stress and fluctuations in blood sugar levels. This application aims to determine the effect of Progressive Muscle Relaxation (PMR) on stress and blood sugar levels in Diabetes Mellitus patients through the evidenced based nursing practice. This study used a quasi-experimental method with one group pretest posttest design. Data collection was carried out using the Diabetes Distress Scale (DDS-17) and blood sugar level measurements. Determination of the sample using purposive sampling of 25 Diabetes Mellitus patients. This study showed that there was a decrease in stress scores of 0.162 points and a decrease in blood sugar levels of 8.12 mg/dl after the implementation of Progressive Muscle Relaxation for 3 days. Progressive Muscle Relaxation has been proven to be effective in reducing stress and blood sugar levels in patients with Diabetes Mellitus and can be used as an evidence-based intervention in nursing care for patients with Diabetes Mellitus.

Keywords: blood sugar; diabetes mellitus; progressive muscle relaxation; stress

How to cite (in APA style)
Mustafida, I., Rayasari, F., Anggraini, D., & Jumaiyah, W. (2024). The Effect of Progressive Muscle Relaxation on Stress and Blood Sugar in Diabetes Mellitus Patients. Indonesian Journal of Global Health Research, 6(S6), 1443-1448. https://doi.org/10.37287/ijghr.v6iS6.4428.

INTRODUCTION

Diabetes Mellitus (DM) is a chronic and long-term condition in which there is a metabolic disorder in the pancreas which causes the body to be unable to produce the insulin hormone, not enough or not effectively using insulin so that glucose cannot enter the cells and accumulates in the blood vessels called Hyperglycemia. The prevalence of Diabetes Mellitus is estimated to increase every year. The International Diabetes Federation estimates that the number of people with Diabetes Mellitus will increase by 46% in 2045. Globally, in 2030 it is estimated that the number of people with Diabetes Mellitus will be 643 million people and in 2045 it will be 783 million people. Indonesia currently ranked 5th in the world with the number of people with Diabetes Mellitus as many as 19.5 million people (International Diabetes Federation, 2021). The results of Riskesdas Indonesia in 2018 show that 2,15% of the total population in Jakarta was reported with Diabetes Mellitus.

Long-term hyperglycemia in Diabetes Mellitus causes oxidative stress which increases insulin resistance, thereby increasing blood sugar levels (Jones & Gwenin, 2021). Hyperglycemia in Diabetes Mellitus is also a factor in causing stress, known as Diabetes Distress. The demands of Diabetes Mellitus life can cause feelings of fear, discomfort, disappointment and even depression (Kalra Rakesh Sahay, 2018). Stress and increased blood sugar levels that are not handled properly can cause Diabetes Mellitus patients to experience other physical and psychological complications. Progressive Muscle Relaxation is a stress management intervention that can reduce stress and blood sugar levels. The relaxed condition that occurs causes changes in nerve impulses and provides a sense of psychological calm and reduces the body's metabolic rate in preventing an increase in blood sugar (Sulistyowati et al., 2021).

Many studies have shown that relaxation interventions have an effect on reducing physical and psychological stress. RCT research by (Toussaint et al., 2021) compared the effectiveness of PMR with other interventions such as Guided Imagery and deep breathing. The results of this research, PMR and Guided Imagery show a linear decrease in stress leading directly to physiological and psychological relaxation compared to Deep Breathing. Systematic review research from (Khir et al., 2024) also shows that 93% of the 31 articles analyzed stated that PMR can reduce stress. PMR had a larger effect size (0.51) compared to the stretching intervention. Meta-analysis research conducted by (Anaabawati et al., 2021) shows that Progressive Muscle Relaxation has a strong effect of 0.94 in reducing blood sugar levels compared to Cognitive Behavioral Therapy (p = 0.000). The decrease in blood sugar values was obtained by 80.47 (27.5%) from the average pre value of 292.07 mg/dl and decreased at post by 211.60 mg/dl.

METHOD

This study use a quasy-experimental method with a one group pretest posttest design and 25 sample of Diabetes Mellitus Patients who hospitalized at Persahabatan Hospital Jakarta according to the inclusion and exclusion criteria. The demographic data consisted of respondent characteristics in the form of age, gender, duration of DM, complications and drug therapy. Data collected using the Diabetes Distress Scale (DDS-17) and capillary blood glucose test measurements carried out before and after Progressive Muscle Relaxation. This intervention is carried out by giving progressive muscle relaxation once a day (15-30 minutes) for 3 days with 13 muscle movements. The data obtained were then analyzed to determine the effect of Progressive Muscle Relaxation on stress and blood sugar levels.

RESULT

The search results obtained 5,440 articles which were then filtered and adjusted based on the assessment to produce 4 articles. The results were then analyzed by assessing the quality of the articles to determine one article as the main source of evidenced-based nursing practice.

Table 1.
Respondent characteristics in the form of gender, complications and drug therapy (n= 25)

Variable	f	%
Gender		
Male	7	28
Female	18	72
Complications		
Yes	15	60
No	10	40
Drug Therapy		
Insulin only	19	76
Oral Antidiabetic (OAD) only	2	8
Insulin and OAD	2	8
There is no drug therapy	2	8

Based on table 1, it shows that the majority of respondents were female as many as 18 respondents (72%), had complications were 15 respondents (60%) and received insulin therapy were 19 respondents (76%).

Table 2.
Respondent characteristics in the form of age and duration of Diabetes Mellitus (n= 25)

Variable	Mean	Min-Max	SD	95% CI	
				Lower	Upper
Age	61.2	43 – 80	10.62	57.24	64.96
Duration of DM	7.4	0 - 49	10.74	3.92	11.72

Based on table 2, The respondents' ages ranged from 43-80 years with an average age of 61 years, the average duration of DM was 7.4 years with the lowest duration being 0 (only discovered during current treatment) and the longest being 49 years.

Table 3.
Value of stress and blood sugar levels before (Pretest) and after (Posttest) Progressive Muscle Relaxation

Variables	Mean	Min-Max	SD	95% CI	
				Lower	Upper
Stress					
Before	2.4	1 – 3	0.55	2.18	2.63
After	2.24	1 - 4	0.61	2.01	2.48
Blood Sugar Levels					
Before	174.72	117 – 237	39.78	159.61	190.27
After	166.60	106 – 305	52.50	146.76	186.56

Based on table 3, this study shows a decrease in stress and blood sugar levels after the application of Progressive Muscle Relaxation. The average stress before the application (pretest) was 2.4 while the average stress after the application (posttest) was 2.24. The average blood sugar level before the application (pretest) was 174.72 mg/dl, while the average blood sugar level after the application (posttest) was 166.60 mg/dl.

Table 4.
Paired T-test for Stress value

Variable	n	Mean	SD	95% CI	P value
Stress	25	0,162	0,295	0,04 – 0,28	0,011

The results of the stress variable using the Paired T-test show that p value <0.05, namely 0.011, indicating that there was a difference in the average stress value before and after the application of Progressive Muscle Relaxation with a mean decrease in stress value was 0.162.

Table 5.
Wilcoxon signed rank test for blood sugar level

Variable	f	Negative Rank	Positive Rank	Ties	P value
Kadar Gula Darah	25	18	7	0	0,166

The analysis of blood sugar level variables using the Wilcoxon signed rank test show that p value> 0.05, which is 0.166 that indicating that there is no significant difference in blood sugar levels between before and after the application of Progressive Muscle Relaxation. Negative Rank were 18, but there were Positive Rank or increased blood sugar level were 7, while Ties or the same blood sugar levels between before and after were 0.

DISCUSSION

Characteristics based on age

The results of this study showed that the average age of respondents was 61 years with the youngest age is 43 years and the oldest age is 80 years. From the age distribution, it was found that respondents experienced moderate to severe distress and experienced fluctuations in blood sugar levels. These results are in line with research (Bhaskara et al., 2022) that Diabetes patients who in productive age (<56 years) and retired age (>56 years) mostly experience stress, Where at productive age 65.6% and 55% of Diabetics of retired age experienced stress. Age is also correlated with fluctuations in blood sugar levels (p value 0.003) that blood sugar in the elderly (>65 years) shows a higher average value (compared to young age (18-35 years) (Giezenaar et al., 2020).

Age increases chronic inflammation in the elderly that effect insulin resistance. In addition, fat metabolism disorders caused by aging can increase the accumulation of free fatty acid concentrations in the blood which trigger insulin resistance (Ismail et al., 2021). Age also affects physical activity in Diabetics, according to research (Assah Berliana et al., 2023) people aged >40 years tend to be less active, lose weight, lose muscle mass and degenerative processes trigger progressive shrinkage of β cells which causes glucose intolerance. In addition, high blood glucose concentrations cause increased cross-linking of protein glycosylation which can increase tendon stiffness making it susceptible to contracture (Yudha Prakasa, 2020). For this reason, Progressive Muscle Relaxation is one of the muscle movement techniques that can be a physical activity and cause a relaxing effect on Diabetics.

Characteristics based on gender

In this application, the majority of respondents were female 18 respondents (72%) compared to males. The prevalence of late-diagnosed Diabetes disease shows that females contribute higher at ages >60 years (Kautzky-Willer et al., 2023). The distribution of respondents by gender shows moderate to severe distress that is evenly distributed. The results of this study also show varying blood sugar levels in both male and female genders. This is in line with research (Bhaskara et al., 2022) that gender is a factor that is not related to Diabetes distress (p value 0.81) because the interaction of this factor is not directly related to stress in Diabetes.

Characteristics based on the duration of DM

The average duration of DM in this study was 7.4 years which can be categorized as a chronic disease. In line with research (Zhang et al., 2024) showing that the duration of Diabetes affects the high degree of distress (p value 0.035) where long-term Diabetes can cause several complications, resulting in poor regimen management and glycemic control.

Characteristics based on complications

Most respondents were found have complications of Diabetes as many as 15 respondents (60%) and 24 respondents (96%) were treated with secondary diagnoses of other diseases that worsened the condition such as cancer, brain tumors, endometrial bleeding and Gastroenteritis with dehydration. Diabetic chronic complications are known to be one of the factors associated with Diabetes distress, Diabetes complications also known to have other impacts such as impaired social and family functioning, social isolation related to disability, increased dependence on others, decreased work ability, and financial problems. (Bhaskara et al., 2022). Other diseases or comorbidities also increase the risk of unstable blood glucose levels. Comorbidities affect a person's blood glucose levels by disrupting the balance of metabolism in the body (Wulandari et al., 2021).

Characteristics based on therapy

As many as 19 respondents (76%) were known to receive insulin therapy in the inpatient room of Persahabatan Hospital. Based on research, (Bhaskara et al., 2022) patients with insulin therapy can experience more severe distress than patients with Antidiabetic drugs (OAD) and diet therapy. The use of insulin therapy requires more complex efforts than Antidiabetic drugs, especially in elderly patients, patients with insulin therapy also have poor glycemic control and have more chronic complications that cause anxiety about their illness. From a financial perspective, insulin therapy requires more expensive costs and has risk of hypoglycemia as a side effect of the drug. These things can cause distress in Diabetics.

Differences in stress values and blood sugar levels

In this study, the results of analysis stress value using the Paired T-test show that p value <0.05, namely 0.011 that indicate there is a difference in the average stress value before and

after the application. The decrease in the average value of Stress between before and after was obtained as much as 0.162. However, categorically both before and after the application, the average Distress that occurred was still in the same category, namely moderate Distress and the domain that had the highest score was emotional burden both Pretest and Posttest. This is in line with research (Zhang et al., 2024) the prevalence of Diabetes distress mostly experienced is moderate Distress, which is 24.29% with the highest score is in the emotional burden domain.The blood sugar level variable also experienced a decrease in value between before and after Progressive Muscle Relaxation, which was 8.12 mg/dl. However, the results of the bivariate analysis of the blood sugar level variable using the Wilcoxon Signed Rank Test show that *p value* > 0.05, which was 0.166 that indicating there was no significant difference in blood sugar levels between pretest and posttest. Fluctuations in blood sugar levels are influenced by physical and psychological factors. This study found that participants who had high stress scores also has high blood sugar levels.

Diabetes Mellitus causes oxidative stress which affects production of hormone cortisol glucocorticoids that play a role in glucose homeostasis and psychological stress. Increased hormone cortisol can trigger insulin resistance through activation system immune and factors inflammation adipokines, so that insulin does not work effective (Dwi Putri et al., 2023). Progressive muscle relaxation can activate parasympathetic nerve that relay to hypothalamus and lowers neurosecretory stimulation in the release of Corticotropin Releasing Hormone (CRH) hormone into the anterior pituitary and inhibits the release of Acrenocorticotropic Hormone (ACTH) into the circulation. Inhibited ACTH also can inhibit a stimulation of adrenal cortex for secrete cortisol in the adrenal medulla which plays a role in stress and produce catecholamine hormone especially epinephrine and norepinephrine which can increase flow blood to muscle, brain and increase insulin sensitivity so that help lower blood sugar levels (Hilda et al., 2023).

CONCLUSION

The Progressive Muscle Relaxation carried out for 3 days can decrease 0.162 in stress values and blood sugar levels of 8.12 mg/dl. It can be a nursing therapeutic intervention to prevent and treat stress and increased blood sugar levels in Diabetes Mellitus patients. Progressive muscle relaxation can be provided in the discharge planning process for inpatients, so that the patient can practice during the treatment to manage stress and decrease blood sugar level which will impact on preventing complication both physical and psychological.

REFERENCES

Anaabawati, M., Rumahorbo, H., Sri Endang Pujiastuti, R., & Kesehatan Kemenkes Semarang, P. (2021). Effectiveness of Cognitive Behavioral Therapy and Muscle Relaxation on Fasting Blood Sugar Levels among Type 2 Diabetes Mellitus: A Systematic Review Nursing Student, Postgraduate Program, Master of Applied Health 2. International Journal of Nursing and Health Services (IJNHS), 4(2), 153–161. https://doi.org/10.35654/ijnhs.v4i2.414

Assah Berliana, P., Asep Rustiawan, drh, Kesehatan Masyarakat, F., & Ahmad Dahlan Jalan Soepomo, U. (2023). Hubungan Aktivitas Fisik Dan Usia Dengan Kadar Gula Darah Pada Pasien Diabetes Melitus Tipe Ii Di Wilayah Kerja Puskesmas Gondokusuman 1 Kota Yogyakarta Tahun 2023.

Bhaskara, G., Budhiarta, A. A. G., Gotera, W., Saraswati, M. R., Dwipayana, I. M. P., Semadi, I. M. S., Nugraha, I. B. A., Wardani, I. A. K., & Suastika, K. (2022). Factors Associated with Diabetes-Related Distress in Type 2 Diabetes Mellitus Patients. Diabetes, Metabolic Syndrome and Obesity, 15, 2077–2085. https://doi.org/10.2147/DMSO.S363431

Dwi Putri, A., Yanti, N., Studi Prodi Sarjana Terapan, P., Ners, P., Kesehatan Kemenkes Padang, P., Barat, S., & Keperawatan, J. (2023). Teknik Relaksasi Otot Progresif Pada Pasien DM Tipe 2 Dengan Ketidakstabilan Kadar Glukosa Darah : Case Report. JHCN Journal of Health and Cardiovascular Nursing, 3(2), 109. https://doi.org/10.36082/jhcn.v3i2.1444

Giezenaar, C., Lange, K., Hausken, T., Jones, K. L., Horowitz, M., Chapman, I., & Soenen, S. (2020). Effects of age on acute appetite-related responses to whey-protein drinks, including energy intake, gastric emptying, blood glucose, and plasma gut hormone concentrations—A randomized controlled trial. Nutrients, 12(4). https://doi.org/10.3390/nu12041008

Hilda, K., Iftitah Alam, R., Keperawatan, I., Kesehatan Masyarakat, F., & Penulis Korespondensi, E. (2023). Relaksasi Otot Progresif terhadap Tingkat Stres pada Pasien Diabetes Melitus Tipe 2. In Window of Nursing Journal (Vol. 4, Issue 1).

International Diabetes Federation. (2021). IDF Diabetes Atlas 10th edition. www.diabetesatlas.org

Ismail, L., Materwala, H., & Al Kaabi, J. (2021). Association of risk factors with type 2 diabetes: A systematic review. In Computational and Structural Biotechnology Journal (Vol. 19, pp. 1759–1785). Elsevier B.V. https://doi.org/10.1016/j.csbj.2021.03.003

Jones, C., & Gwenin, C. (2021). Cortisol level dysregulation and its prevalence—Is it nature's alarm clock? In Physiological Reports (Vol. 8, Issue 24). American Physiological Society. https://doi.org/10.14814/phy2.14644

Kalra Rakesh Sahay, S. (2018). Diabetes Fatigue Syndrome. Diabetes Ther, 9, 1421–1429. https://doi.org/10.6084/m9.figshare.6304445

Kautzky-Willer, A., Leutner, M., & Harreiter, J. (2023). Sex differences in type 2 diabetes. Diabetologia, 66, 986–1002. https://doi.org/10.1007/s00125-023-05891-x/Published

Khir, S. M., Azam, W. M., Yunus, W. M., Mahmud, N., Wang, R., Panatik, S. A., Saipol, M., Sukor, M., & Nordin, N. A. (2024). Efficacy of Progressive Muscle Relaxation in Adults for Stress, Anxiety, and Depression: A Systematic Review. https://doi.org/10.17605/OSF.IO/U2HZP

Sulistyowati, R., Kemenkes Palangka Raya, P., Raya, P., & Tengah, K. (2021). Manfaat Relaksasi Otot Progresif Bagi Klien Dm Tipe Ii Untuk Mengurangi Gejala Fatigue Benefits Of Progressive Muscle Relaxation For Type II DM Clients To Reduce Fatigue Symptoms. Jurnal Surya Medika, 6(2), 45–52. https://doi.org/10.33084/jsm.vxix.xxx

Toussaint, L., Nguyen, Q. A., Roettger, C., Dixon, K., Offenbächer, M., Kohls, N., Hirsch, J., & Sirois, F. (2021). Effectiveness of Progressive Muscle Relaxation, Deep Breathing, and Guided Imagery in Promoting Psychological and Physiological States of Relaxation. Evidence-Based Complementary and Alternative Medicine, 2021. https://doi.org/10.1155/2021/5924040

Wulandari, I., Kusnanto, K., Wibisono, S., Andriani, B., Wardani, A. R., & Huri, S. A. (2021). Factors Affecting Blood Glucose Stability in Type 2 Diabetes Mellitus Patients.

Yudha Prakasa, D. (2020). Musculoskeletal Complications in Diabetes Mellitus Patients Komplikasi Muskuloskeletal pada Pasien Diabetes Melitus Musculoskeletal Complications in Diabetes Mellitus Patients Artikel info Artikel history. Jurnal Ilmiah Kesehatan Sandi Husada, 9(2). https://doi.org/10.35816/jiskh.v10i2.454

Zhang, Y. Y., Li, W., Sheng, Y., Wang, Q., Zhao, F., & Wei, Y. (2024). Prevalence and Correlators of Diabetes Distress in Adults with Type 2 Diabetes: A Cross-Sectional Study. Patient Preference and Adherence, 18, 111–130. https://doi.org/10.2147/PPA.S442838