

The Decreased Blood Sugar Levels of Type 2 Diabetes Mellitus Patients with Progressive Muscle Technique

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Abstract: The prevalence of diabetes that occurred in 2015 was 9.3% and is estimated to increase every year. Type 2 diabetes occurs because of insulin resistance, where glucose fails to enter cells, usually at the age of 30 years. One modality therapy that can be done is progressive muscle relaxation. The purpose of this study was to identify the effect of progressive muscle relaxation therapy on reducing blood sugar levels in patients with type 2 diabetes mellitus at GRANDMED Lubuk Pakam hospital. This research method uses a pre-experimental design with one group pretest-posttest. The sample size of 10 respondents was selected by using non-probability sampling type consecutive sampling. The paired hypothesis test results from the uij-t sample at a significance level of 95% obtained p value $< \alpha$, which is 0.001, showed that there was an effect of progressive muscle relaxation therapy to reduce blood glucose levels in patients with type 2 diabetes mellitus. The conclusion was that there was a significant difference between blood glucose levels before and after progressive muscle relaxation therapy. It is recommended that health care institutions need to implement new policies related to the application of progressive muscle relaxation technique therapy.

1 INTRODUCTION

Based on 2015 International Diabetes Federation (IDF) estimates, there are 177 million people in the world who suffer from type 2 diabetes mellitus and it is predicted that in the next 25 years it will increase to 300 million people (Sudoyo, et al. 2006). The prevalence of type 2 diabetes in 2016 in the population of the United States aged 65 years or more is around 10.9 million people (26.9%).

This disease is a major cause of heart disease and stroke, and is a leading cause of death. For handling reduced blood sugar levels only rely on pharmacological therapy, such as the use of insulin injection. Surwit et al. (2014) from Duke University Medical Center, USA, stated that stress management techniques when accompanied by standard treatments can help reduce blood glucose levels. The reduction achieved was also almost as large as the results one would expect from diabetes control drugs. Surwit and his team studied 108 type 2 DM patients and acute DM patients in adults.

All respondents underwent DM education sessions for 30 minutes and half of the respondents were also asked to follow guidelines for dealing with

stress. After a year, as many as 32% of patients who have knowledge about stress management are recorded to have decreased blood sugar by one percent or more. While a decrease in blood sugar levels was only 12% among respondents who did not have the knowledge to deal with stress. Surwit further stated that stress directly affects DM.

In Indonesia the number of type 2 diabetes mellitus patients has increased, from 8.4% million people in 2017 and is estimated to be around 21.3% million people in 2022. The high morbidity rate makes Indonesia ranks fourth in the world after the United States, India, and China (Wild et al, 2018). In North Sumatra, especially H. Adam Malik Hospital in Medan based on disease patterns and various age levels, the number of cases of diabetes mellitus occupies number two after malignant neoplasm, while based on data on death patterns according to the disease causing the death of patients treated in H. Adam Malik Medan DM ranks 16th with 430 people out of 37,279 people with other disease deaths (North Sumatra Health Office, 2009). Based on data obtained by researchers on November 4, 2018 at the Grandmed Lubuk Pakam Hospital, there were 340 patients with type 2 diabetes mellitus in the past year, and based on preliminary studies conducted by the author on November 4, 2018 data obtained from medical

GRANDMED Hospital record Lubuk Pakam, sufferers of internal medicine who were treated since January 2018 - December 2018 as many as 20,506 people. Among patients with internal diseases, there were 568 people with disorders of the "Diabetes Mellitus Type 2" endocrine system with a prevalence of 2.77% consisting of 328 (57.8%) men and 240 (42.2%) women. Meanwhile, in handling to reduce blood sugar levels in patients with Type 2 Diabetes Mellitus, RS. GRANDMED Lubuk Pakam itself still relies on pharmacological therapy, such as the administration of insulin injections to control blood sugar levels of Type 2 Diabetes Mellitus patients and various types of oral drugs such as Metformin.

Diabetes mellitus is a collection of symptoms in a person caused by an increase in blood glucose levels due to a progressive decrease in insulin secretion by insulin resistance. This condition is characterized by the inability of the organ's inability to use insulin, so insulin cannot function optimally in regulating glucose metabolism. As a result, blood glucose levels increase (hyperglycemia). Hyperglycemic characteristics aside from abnormalities of insulin secretion can also occur because insulin does not work or both (Bustan, 2012).

Hyperglycemia is characterized by blood sugar levels when more than 11.1 mmol / l (> 200 mg / dl) (WHO, 2012). Increased blood sugar levels in patients with diabetes mellitus associated with stress. Stress conditions with people with diabetes mellitus are very closely related. Stress is a condition where the body's needs are not met adequately, so that it will result in disruption of balance. Stress activates the neuroendocrine system and the sympathetic nervous system through the pituitary-adrenal hypothalamus, causing the release of hormones such as epinephrine, thyroid, cortisol, and glucagon which can affect blood sugar levels (Hasaini, 2015).

In normal insulin conditions glucose intake or glucose production in the body will be facilitated (by insulin) to enter the body's cells. Glucose is then processed to become energy materials. If the energy material needed is still remaining, it will be stored as glucogen in liver cells and muscle cells (as muscle cell mass). The process of glycogenesis (formation of glycogen) from the element of glucose can prevent hyperglycemia. In patients with diabetes mellitus this process cannot take place properly so that glucose accumulates in the blood (hyperglycemia). Hyperglycemia will result in the rapid growth of various microorganisms such as fungi and bacteria. Because these microorganisms are well suited to areas that are rich in glucose. Every time inflammation arises, there will be an inflammation mechanism, there will be an increase in blood

mechanism in the injured tissue. That condition makes microorganisms get a supply of nutrients. This condition will cause diabetes mellitus sufferers to be easily infected by bacteria and fungi.

Relaxation technique is one of the nursing actions that can reduce anxiety and can automatically reduce blood sugar levels. Relaxation can influence the hypothalamus to regulate and decrease sympathetic nervous system activity. Stress can not only increase blood sugar levels physiologically. Patients in stress can also change their good habits, especially when it comes to eating, exercise and medication. Progressive muscle relaxation can be widely applied to all people in various conditions (Setyohadi and Kushariyati, 2011). Progressive muscle relaxation is known to help reduce blood glucose levels in patients with diabetes mellitus because it can suppress the release of hormones that can increase blood glucose levels, namely epinephrine, cortisol, glucagon, adrenocorticotropic hormone (ACTH), corticosteroids, and thyroid. The sympathetic system will dominate when a person is relaxed and calm, the dominance of the sympathetic nervous system stimulates the hypothalamus to decrease the secretion of Corticotropin-Releasing Hormones (CRH).

Cell starvation also results in increased mobilization and metabolism of free fatty acids (lipolysis), triglycerides and glycerol which circulates and makes the liver substrate available for the ketogenesis process used by cells to carry out cell activity. Ketogenesis results in increased levels of organic acids (ketones), while ketones use the body's alkaline reserves to decrease blood PH buffer. Kusmaul breathing is stimulated to compensate for the state of metabolic acidosis. Osmotic diuresis is made worse by the presence of ketoanemia and from protein catabolism which increases protein intake to the kidneys so that the body loses a lot of protein. The existence of cellular starvation will increase the body's adjustment mechanism will increase income with the emergence of a feeling of wanting to eat continuously (polifagi). Cellular starvation will also cause clinical symptoms of bodily weakness due to decreased energy production. And damage to various reproductive organs, one of which can arise impotence and other organs such as peripheral innervation and eyes (appear numbness and blurred eyes).

The reduction in CRH will also affect adenohypofisis to reduce the secretion of adrenocorticotropic hormone (ACTH), which is carried through the bloodstream to the adrenal cortex. This condition can eliminate the adrenal cortex to release the hormone cortisol. Decreased cortisol

hormone will inhibit the process of gluconeogenesis and increase the use of glucose cells (Guyton & Hall, 2008; Sherwood, 2014).

Progressive muscle relaxation can be done by everyone in a variety of conditions. Relaxation is known to help reduce blood glucose levels in patients with diabetes mellitus because it can suppress the release of hormones that can increase blood glucose levels, namely epinephrine, cortisol, glucagon, adrenocorticotropic hormone (ACTH), corticosteroids, and thyroid. The sympathetic system will dominate the situation of someone who is relaxed and calm, the dominance of the sympathetic nervous system will stimulate the hypothalamus to decrease the secretion of Corticotropin-Releasing Hormone (CRH). The reduction in CRH will also affect adenohypofysis to reduce the secretion of Adenocorticotropic hormone (ACTH), which is carried through the bloodstream to the adrenal cortex. This condition can inhibit the adrenal cortex to release the hormone cortisol. Decreased cortisol hormone will inhibit the process of gluconeogenesis and increase the use of glucose by cells

2 RESEARCH METHODS

This type of research is quantitative with quasi-experimental design (quasi-experimental) using a one-group pretest-posttest approach. The location of this research was conducted at GRANDMED Hospital Lubuk Pakam. The sample in this study was type 2 diabetes mellitus patients at Grandmed Lubuk Pakam Hospital. The sampling technique used is nonprobability sampling, namely purposive sampling. The number of samples is 10 people.

The analysis technique used is the T-test with a confidence level of 95% or paired ($p \leq 0.05$) (Notoatmodjo). T-test is done when analyzing data. The type of data used in the independent variable is categorical and the dependent variable is numeric. (Sugiyono, 2012).

The sample is a portion of the entire object studied and is considered to represent the entire population (Notoatmodjo, 2012). The sample in this study were patients with type 2 diabetes mellitus at Lubuk Pakam GRANDMED Hospital. This research was conducted for 2 weeks

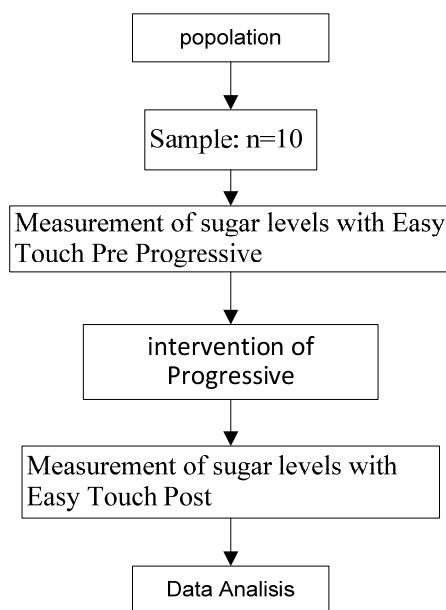


Figure 1: Research flow.

Here are what need to be considered in doing progressive muscle relaxation techniques. a) Don't overexert muscle tension because it can hurt yourself. b) it takes around 20-50 seconds to relax the muscles. c) pay attention to body position. d) tensing muscle groups twice the tension. e) do the right part of the body twice, then the left part twice. f) check whether the client is really relaxed. The steps for progressive muscle relaxation are as follows. The main goal of diabetes therapy is to normalize insulin activity and blood glucose levels to reduce complications caused by diabetes mellitus. The trick is o maintain glucose levels within normal limits without hypoglycemia and maintain a good quality of life.

The following is a standard operational procedure for progressive muscle training can be seen in the figure 2 below



Figure 2: Standart Operatour Procedur.

3 RESULTS AND DISCUSSION

Based on the results of data analysis, it can be seen that blood sugar levels in diabetic patients before progressive muscle relaxation techniques that only use insulin injection therapy are 10 respondents, with an average blood sugar level of 244 mg / dl. From the results of the study it can be assumed that the administration of progressive muscle relaxation techniques to patients with type 2 diabetes mellitus is significant.

The results of this study are in line with research conducted by Widianingsih (2017), in Pukesmas Pondok Jagung, South of Tangerang City that the provision of progressive muscle relaxation techniques in patients with type 2 diabetes mellitus can reduce blood sugar levels with a value of $p = 0.001$, from the study muscle relaxation techniques progressive significant effect to reduce blood sugar levels.

Type of 2 diabetes mellitus is a complex chronic disease that involves carbohydrate, protein and fat metabolism disorders and the development of macrovascular and neurological complications. Progressive muscle relaxation techniques are deep muscle relaxation techniques that do not require imagination, perseverance, or suggestion. Based on the belief that the human body responds to anxiety and events that stimulate the mind with muscle tension. Progressive muscle relaxation techniques focus on a muscle's activity by identifying tense muscles and then reducing tension by doing relaxation techniques to relax. (Kustanti and Widodo, 2008). The results showed blood sugar levels in patients with type 2 diabetes mellitus before progressive muscle relaxation was carried out at 243.90, with a standard deviation (SD) of 11.210 and an error standard (SE) of 3, 54.

From the results of the study it can be assumed that the administration of insulin injection therapy in patients with type 2 diabetes mellitus without the provision of progressive muscle relaxation techniques, the results are not so significant. From the results of Damayanti's study (2017), in the pondok mukut of pondok pondok in south tangerang city that the provision of progressive muscle relaxation techniques in type 2 diabetes mellitus patients can reduce blood sugar levels by $p = 0,000$, from the study progressive muscle relaxation techniques significantly influence levels to reduce levels blood sugar.

Progressive muscle relaxation technique is a relaxation therapy given to the client by tensing certain muscles and then relaxation. Progressive

relaxation is a method of relaxation technique that combines deep breathing exercises and a series of series of contractions and certain muscle relaxation (Thomson, 2014).

Results of Analysis of Blood Sugar Levels After the Progressive Muscle Relaxation Technique of 200.80 with standard deviation (SD) 31.407 and standard error (SE) 9.932. significant effect to reduce blood sugar levels. The researcher's assumption is that progressive muscle relaxation techniques can be used to reduce blood sugar levels in patients with type 2 diabetes mellitus so that they can gradually maintain and improve conducive health

Someone with a chronic disease or serious illness can experience a stressful condition that will trigger the release of several hormones that contribute to increasing blood sugar levels, namely glucagon, epinephrine, growth hormone and glucocorticoids. Stress patients can change their good habits, especially eating, exercise and treatment. One of the actions that can be taken in patients with chronic stress is complementary therapy. This therapy is a natural treatment to deal with the causes of disease and stimulate the body itself to cure the disease. Complementary therapies include herbal therapy, breathing exercises, meditation and relaxation. Relaxation is an effort to relieve emotional tension so that individuals can think more rationally. That is why the production of liver sugar can be controlled properly, so that blood sugar can be stabilized normally.

One form of a way to ease emotional tension that is quite easy to do is progressive muscle relaxation. This technique forces the individual to concentrate on his muscle tension and then train him to relax. People who are stressed, emotionally tense and experiencing muscle tension. This technique seeks to relieve muscle tension in the hope that emotional tension is reduced, so this progressive muscle relaxation technique can be used to accompany conventional techniques that are usually given.

Progressive muscle relaxation therapy which is a form of mind-body therapy in complementary therapy. In relaxing individual muscles will be given the opportunity to learn how to tense a certain group of muscles and then release that tension (Widyawati & Yulianti, 2015).

Progressive muscle relaxation therapy, it is important to note that it must be ended by returning the position to the initial condition before being tense so that you can feel the difference between feeling tense and relaxing. This therapy needs to be done repeatedly to give the best effect.

When the client meets the therapist for progressive muscle relaxation therapy, if done correctly it will certainly bring positive changes. Therefore, this exercise needs to be repeated to have a lasting positive effect.

Juniadi's research results (2018) at Woha Bima Health Center, West of Nusa Tenggara, with $p = 0.004$, from 30 respondents there were 23 who experienced a decrease in blood sugar levels with direct and indirect approaches and outreach on progressive muscle relaxation techniques can reduce blood sugar levels in type 2 diabetes mellitus patients. Based on the belief that the human body responds to anxiety and events that stimulate the mind with muscle tension

Progressive muscle relaxation techniques focus on muscle activity by identifying tense muscles and then reducing tension by using relaxation techniques to relax. (Herod, 2010).

Results of Analysis of Blood Sugar Levels Before And After The Progressive Muscle Relaxation Technique At GRANDMED Hospital Lubuk Pakam in 2019 was 43,100, with a standard deviation (SD) 27,795 and an error standard (SE) of 8,789. Statistical test results obtained $p \text{ value} = 0.001$ $\alpha = 0.05$, it can be concluded that there is an influence of progressive muscle relaxation techniques on blood sugar levels in patients with type 2 diabetes mellitus. According to Bamedh (2006) physical activity has a significant relationship with extremity disorders where activity low physical, one of which does not regularly exercise the risk of movement disorders. This mechanism can increase blood sugar levels in type 2 DM patients.

The results of this study are in accordance with Nakayama et al (2012) saying that muscle contraction and exercise can reduce blood glucose levels in patients with Type 2 Diabetes Mellitus by increasing glucose uptake in skeletal muscle through translocation of glucose transporter 4 (GLUT 4) to the surface cell. According to Ghazavi, et al (2007), that relaxation exercises given to DM patients can reduce HbA1C levels.

This research is in accordance with existing theories and in line with previous studies. The results of a study conducted by Widianingsih (2017), about the effect of progressive muscle relaxation techniques on reducing blood sugar levels in type 2 diabetes mellitus patients. This study used a pretest-posttest control group design method with a sample of 40 people, 20 as a treatment group and For 20 control groups, the sampling technique used purposive sampling and used paired sample t-test.

This research is supported by Duning's (2013) statement that complementary therapy provides benefits for diabetic patients by increasing the acceptance of current conditions, reducing stress, anxiety and depression, developing strategies to prevent ongoing stress, increasing patient involvement in the process of healing diabetes mellitus. The same study conducted by Yildirman & Fadiloglu (2016) states that progressive muscle relaxation decreases anxiety and improves the quality of life of patients undergoing dialysis.

Progressive muscle relaxation techniques activate the sympathetic nervous system and stop the work of the sympathetic nerves so that the hormone cortisol decreases. Pawlow's study (2015) shows that there is an effect of muscle relaxation on salivary cortisol levels and if done regularly will reduce the risk of diabetes mellitus. The same study conducted by Maghrifah (2015) shows that there is an effect of the progression of muscle relaxation on stress in patients with type 2 diabetes mellitus.

Type 2 diabetes mellitus is a disease characterized by an increase in blood sugar levels (hyperglycemia) due to impaired insulin secretion, insulin activity or both, so insulin is needed. As for the attention to be given insulin is given at the peak, how to store insulin, preparation and rotation, and injection techniques. As a result, the range of insulin doses is quite far, ranging from 24 units to 36 units. This disease can be influenced by age, lifestyle, sex, and can cause complications. Based on research relaxation can reduce blood sugar levels significantly.

Physical exercise is one of the pillars of DM management (Perkeni, 2011). Progressive muscle relaxation exercises can be done as one of the physical exercises for DM patients. This exercise is done to get relaxation by tensing and stretching the muscles routinely to have an impact on increasing glucose transference into the cell membrane. This increase makes the use of glucose levels more effective so that levels can be near normal or stable. Blood sugar levels in DM patients are related to the stress they face. Stress activates the neuroendocrine system and the sympathetic nervous system through the hypothalamic pituitary-adrenal system which causes the release of hormones such as epinephrine, cortisol, ACT, glucagon, corticosteroids, and thyroid which can affect blood glucose levels in people with DM. In addition during emotional stress, DM patients are also associated with poor self-care such as education, nutritional therapy or meal planning, pharmacological techniques, monitoring blood sugar levels and physical exercise (Hasaini, 2015).

One form of a way to ease emotional tension that is quite easy to do is progressive muscle relaxation. This technique forces the individual to concentrate on his muscle tension and then train him to relax. People who are stressed, emotionally tense and experiencing muscle tension. This technique seeks to relieve muscle tension in the hope that emotional tension is reduced, so this progressive muscle relaxation technique can be used to accompany conventional techniques that are usually given

The benefits of progressive muscle relaxation exercises are improving blood circulation. Increasing blood circulation will help the process of absorption and removal of metabolic remnants from the tissues and facilitate the distribution of nutrients. Increased circulation allows more efficient absorption of insulin by cells because of the blood circulation of people with DM oftendisturbed due to the effects of increased blood sugar levels on body cells.

Progressive muscle relaxation works by alternating movements between stretching and relaxation, easy to learn and the results are quickly felt. Progressive muscle relaxation will inhibit stress feedback pathways and relax the patient's body. The parasympathetic system will dominate in a relaxed state where some of the effects are caused by reducing the speed of heart contractions and stimulating the secretion of the hormone insulin.

The results of this study indicate that progressive muscle relaxation for patients with type 2 diabetes mellitus greatly affects a decrease in blood sugar levels, compared with those who do not. Relaxation can reduce blood sugar levels in patients with type 2 diabetes mellitus by suppressing the release of hormones that can increase blood sugar levels, namely epinephrine, cortisol, glucagon, adrenocorticotropic hormone (ACTH), corticosteroids and thyroid.

According to Barneth (2016) physical activity has a significant relationship with physical limb disorders that are very low, one of which is not regularly exercising the risk of movement disorders. This mechanism can increase blood sugar levels in Type 2 DM patients.

Thus, progressive muscle relaxation can help reduce blood sugar levels by: a) suppressing epinephrine release thereby inhibiting the conversion of glycogen to glucose, b) suppressing cortisol expenditure inhibiting glucose metabolism, so that amino acids and lactate remain stored in the liver in the form of glycogen as energy reserves, c) restrain the release of gluagone inhibit the conversion of glycogen in the liver into glucose and d) relaxation can suppress ACTH and glucorticoids in the adrenal

cortex so that it can suppress the formation of new glucose by the liver so as to reduce blood sugar levels.

4 CONCLUSION

Based on the results of the statistical tests and the discussion above, it can be concluded that there is an effect of progressive muscle relaxation techniques on reducing blood sugar levels in type 2 diabetes mellitus patients at GRANDMED Lubuk Pakam Hospital in 2019:

- Average blood sugar level results before progressive muscle relaxation techniques from 10 respondents with type 2 diabetes mellitus patients with a result of 244 mg / dl.
- Average blood sugar level results after progressive muscle relaxation techniques from 10 respondents with type 2 diabetes mellitus patients with a yield of 201 mg / dl.
- There is an effect of progressive muscle relaxation techniques on reducing blood sugar levels in patients with type 2 diabetes mellitus. Based on the results of statistical tests using paired t-test, it shows that the p value is 0.001, which means the p value $< \alpha = 0.05$.

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