



PROGRESSIVE MUSCLE RELAXATION (PMR) IS EFFECTIVE TO LOWER BLOOD GLUCOSE LEVELS OF PATIENTS WITH TYPE 2 DIABETES MELLITUS

M. Agung Akbar¹, Hema Malini², Esi Afriyanti³

1. Bachelor of Nursing Student, Faculty of Nursing, Andalas University, Indonesia
2. Associate Professor, Faculty of Nursing, Andalas University, Indonesia
3. Lecturer, Faculty of Nursing, Andalas University, Indonesia

ABSTRACT

Most of the management for hospitalized patient with type 2 Diabetes Mellitus (T2DM) is still concentrated on medication and diet. On the other hand, exercise or activity management, however, gets little attention. Health professionals, especially nurses, need to be aware that some exercises or activities should be provided even for hospitalized patients. One of the choices is Progressive Muscle Relaxation (PMR). The purpose of this study was to determine the effect of PMR on reducing blood glucose levels in patients with T2DM. This research used the quasi-experimental with pre and post control group design. The sampling technique was simple random sampling with 30 samples, that divided into intervention and control groups (15 samples in each group). Data collection techniques were performed by measuring the blood glucose levels at that time. PMR as an intervention was performed for three days on a regular basis. Afterward, the blood glucose levels were remeasured. Data analysis was done by using t-test. Data analysis showed that there was a decrease in mean score of blood glucose levels for 63,80 mg/dl in the control group and 80,46 mg/dl in the intervention group. The results showed that PMR was effective in reducing the blood glucose levels of hospitalized patients with T2DM (p-value = 0,015). The results of this study can be applied by nurses as an alternative intervention in the management of patients with T2DM.

Keyword : Blood glucose, nursing intervention, physical activity

ABSTRAK

Manajemen pasien dengan Diabetes Mellitus tipe 2 (T2DM) yang dirawat di rumah sakit seringkali masih hanya berfokus pada pengobatan dan diet. Di sisi yang lain, olah raga atau manajemen aktivitas masih kurang mendapat perhatian. Tenaga kesehatan, terutama perawat, perlu menyadari bahwa olah raga atau aktivitas tetap dapat diberikan kepada pasien meskipun dirawat di rumah sakit. Salah satunya adalah dengan Relaksasi Otot Progresif (ROP). Tujuan dari penelitian ini adalah untuk menentukan pengaruh ROP terhadap penurunan kadar gula darah pada pasien DM tipe 2. Penelitian ini menggunakan desain kuasi eksperimental pre dan post. Tehnik sampling yang digunakan adalah simple random sampling pada 30 orang, yang dibagi atas kelompok intervensi dan kelompok kontrol (masing-masing 15 orang pada setiap grup). Teknik pengumpulan data dilakukan dengan mengukur kadar gula darah sewaktu. Intervensi ROP dilakukan selama tiga hari berturut-turut. Setelah itu, kadar glukosa darah diukur kembali. Analisa data menggunakan t-test. Hasil analisa menunjukkan bahwa terdapat penurunan rerata kadar gula darah sebesar 63,80 mg/dl di kelompok kontrol dan 80,46 mg/dl di kelompok intervensi. Hasil menunjukkan bahwa PMR efektif untuk menurunkan kadar gula darah pada pasien DM tipe 2 yang dirawat di rumah sakit (p-value=0,015). Hasil dari penelitian ini diharapkan dapat digunakan oleh perawat sebagai alternative tindakan untuk pasien dengan DM tipe 2.

Kata kunci: Glukosa darah, intervensi keperawatan, aktivitas fisik

BACKGROUND

Diabetes Mellitus (DM) remains a worldwide health issue. The prevalence keeps increasing every year. According to World Health Organization (WHO), in 2014 approximately 422 million people were living with diabetes. An estimated 78,3 million people have diabetes in Southeast Asia, and it is the largest number considering for about one-third of cases globally (WHO, 2016). Type 2 diabetes mellitus (T2DM) is the predominant form of diabetes and accounts for 90-95% of all cases. According to International Diabetes Federation (IDF) (2015), 1 out of 11 adults are diabetic and nearly 80% of diabetics are living in developing countries, one of which is Indonesia.

Indonesia is in the top 7 countries with the largest number of people with diabetes. IDF estimates that in 2015 there are approximately 10 million cases of adults with DM in Indonesia. Basic Health Research Report (Riskesdas) states that the number of DM patients in 2013 is about 6,9% of the total population or nearly 12 million people. In West Sumatra Province, there is a sufficiently number of diabetics, accounting for 1.8% of the total population. West Sumatra Province is ranked 21st for DM case in Indonesia (Balitbang of Department of Health RI, 2013).

Department of Health of Padang city in 2015 reported that DM is the third largest illness referred from Community Health Centres (Puskesmas) accounting for 2592 people. While in 2014, DM is in the second place of 10 most diseases referred by health insurance participants with a total of 2436 patients. Although in 2015 there is a decrease in the ranking from the previous year, an increase occurs in the number of DM patients who are referred to the hospital (Department of Health, 2016).

Type 2 Diabetes Mellitus (T2DM) occurs due to reduced insulin sensitivity or insulin resistance. Normally, insulin is bound by a receptor on the cell surface and begins to unite a series of reactions including glucose metabolism. T2DM may be caused by insensitivity of receptor to the insulin or by low of insulin level and

result in high level of the blood glucose (Tarwoto, Wartonah, Taufiq & Mulyati, 2012). Therefore, physical exercises are required to increase insulin receptors activity in plasma membrane so that it can lower the blood glucose levels (Damayanti, 2015).

Most of the DM management in hospitals are still concentrated on medication and diet, yet there is little attention to physical activity fulfillment. Physical activity will make body's metabolism work more optimal. As a result blood glucose levels will be controlled. Therefore, holistic handling is necessary (Wade & Tavns, 2007).

Physical exercise is an important part of diabetes management. Soegondo (2007) explains that physical exercise leads to an increase in blood flow and opening of more capillary meshes. As a result, insulin receptors are widely available and more active. However, the opportunity to do physical exercise for hospitalized patient is usually decrease due to some circumstances, for example limited movement in lower extremities and environmental barrier (inpatient room design is not supported) (Mahanani, Natalia & Pangesti, 2015; Dewi & Budiharsana, 2014; Niqren, 2014).

Thus, there is a need for exercise that patient can perform during their stay in the hospital. Progressive Muscle Relaxation (PMR) is those kinds of exercises (Mahanani et al., 2015). PMR focuses on tightening and relaxing sequential muscle group. PMR is first introduced by Jacobson in 1938 and is still widely used nowadays. Jacobson explained that PMR could facilitate body's oxygen consumption, increase metabolism, accelerate respiration, relax muscle tension, balance systolic and diastolic blood pressure, and increase alpha brain waves (Synder & Linquist, 2010).

Hasaini (2015) has conducted a study to prove the effectiveness of PMR on blood glucose levels of T2DM patients at Martapura Community Health Center (Puskesmas). PMR was given 1 to 3 times a day for \pm 15-20 minutes to 34 patients. The study showed that there was a

significant difference in blood glucose levels between the intervention group and the control group (p -value $<0,05$).

The similar results were also found in Casman, Fauziyah, Fitriyana and Triwibowo (2015) study at the Puskesmas Suraneggala. This research used pre-experiment with one group pretest-posttest design. PMR was conducted twice per day, in the morning and afternoon, for six consecutive days in 30 respondents. The study showed that there was a significant difference in fasting blood glucose level before and after intervention in PMR group (204,4 mg/dl compared to 155,47 mg/dl).

Both studies were conducted in the community setting where all the respondents were not hospitalized. The respondents could mobilize without any limitation. There is limited literature that explains the implementation of PMR in the hospital setting. The implementation of PMR in hospitals setting could become one of the proposed activity therapy. The PMR provide an alternative for patients who were experienced limited movement. In the hospital, nurses can continuously monitor the accuracy of PMR movements. Therefore, this research was conducted to observe the effectiveness of PMR implementation in lowering blood glucose levels within T2DM patients in hospitals.

This research was conducted in Central General Hospital (RSUP) Dr. M. Djamil Padang, West Sumatra Province, Indonesia. Based on medical records, 1081 T2DM patients had been hospitalized from January to July 2017. From the initial assessment, 15 patients stated that they did not know about the Progressive Muscle Relaxation (PMR) exercise. Of 15 patients, 4 people did physical activity during the hospitalization by doing morning or afternoon walk around the inpatient room. Meanwhile, 9 patients said they just rested in bed. Nurses who were assigned in the Internal Disease Room stated that they have never performed PMR exercise for hospitalized DM patients.

METHOD

This was quasi-experiment research with control group pretest and

post-test design. A total of 30 patients who selected using simple random sampling participated in this study. They were divided into intervention and control group (15 respondents in each group) by drawing the names out. Sample criteria were T2DM patients without diabetes-related complication; received pharmacological and dietary therapy from the hospital; had ≥ 200 mg/dl blood glucose level; and *compos mentis*.

In order to control whether the decrease of the blood glucose level, the pre and posttest measurement of peripheral blood glucose level were conducted for both groups. For the intervention group, the PMR was conducted three times on three consecutive days with duration of 25-30 minutes. Meanwhile for the control group, the routine activity suggestion to the respondents by the nurses in ward.

The research process began by identifying T2DM patients who were suitable with inclusion criteria. Then, researchers explained the research procedures. Informed consent was filed after the patients agreed to become respondents. The researchers measured blood glucose levels by using peripheral blood glucose measuring device before intervention. Then, researchers introduced and explained PMR that would be done three times a day for three consecutive days with duration of 25-30 minutes. The researchers observed the PMR implementation by using observation sheets. After performing PMR for nine times, researchers remeasured blood glucose levels by using the same device.

The data were collected, processed and then analyzed by using univariate and bivariate analysis. Bivariate analysis used t-test to determine effect of PMR in lowering blood glucose levels of diabetics. This research had passed ethical clearance at the Faculty of Medicine, Andalas University of Padang (Approval no: 396 / KEP / FK / 2017) and obtained the written permission from Dr. M. Djamil Hospital before doing the research (Approval no LB.00.02.07.1131).

RESULTS

Table 1. Demographic characteristics of respondents (n=30)

	Intervention (n=15) f (%)	Control (n=15) f (%)
Age, years (Mean, SD)	49,60 (4,68)	51,33 (5,49)
Sex		
Male	4(26,7)	6(40)
Female	11(73,3)	9(60)
Education		
Primary School	0 (0)	0 (0)
Junior High School	5(33,3)	5 (33)
Senior High School	8 (53,5)	9 (60)
Bachelor Degree	2 (13,3)	1 (6,7)
Occupation		
Housewife	7 (46,7)	4 (26,7)
Laborers	3 (20)	3 (20)
Self-Employed	4 (26,7)	6 (40)
Civil Servant	1 (6,7)	2 (13,3)

Characteristics of respondents are described in table 1. Table 1 shows that mean age of respondents in intervention group was 49,60 years old, while in control group was 51,33 years old. Majority of respondents in intervention group were female (73,3%), had senior high school education level (53,5%), and were housewives (46,7%). Similarly in the control group, majority of respondents were female (60%) and had senior high school education level (60%). However, many of them were self-employed (40%).

Table 2. Mean of blood glucose levels (n=30)

	Pre test	Post test	p-value
Intervention	292,07	211,60	0,000
Control	294,13	230,33	0,000

Mean of blood glucose level pre-test and post-test of both groups are shown in table 2. Table 2 shows that mean of blood glucose level at pre-test and post-test in intervention group was 292,07 mg/dl and 211,60 mg/dl respectively. Meanwhile, in the control group, mean of blood glucose level at pre-test and post-test was 294,13 mg/dl and 230,33 mg/dl respectively. Paired t-test in intervention group showed p-value 0,000 ($p < 0,05$) which means that there was a significant differences in blood glucose level before and after PMR intervention. Similar result was also found in control group. There was a significant difference in blood

glucose level on pre and post test ($p < 0,000$).

Table 3. Mean deviation of blood glucose levels (n=30)

	Deviation (mean, SD)	p-value
Intervention	80,46 (20,10)	0,015
Control	63,80 (14,56)	0,015

Table 3 shows mean deviation of blood glucose levels in both groups. Independent t-test showed that there was a significant differences in mean deviation of blood glucose levels between groups ($p=0,015$). It means that PMR is significantly effective to lower blood glucose levels of T2DM patients.

DISCUSSION

Physical activities are beneficial in lowering blood glucose in patients' body because it can increase the cells' absorption. Exercises can enhance blood flow, and the opened capillary mesh increases insulin receptors availability that will reduce blood glucose level in diabetic patients (Soegondo, 2007). For these reasons, physical activities for T2DM patients are very important even when the patients are being hospitalized.

In this study, it was found that there is a significant difference in blood glucose levels of pre-test and post-test in the intervention group as the effect of PMR exercise to lower blood glucose

levels in patients with T2DM. In another study, PMR effectiveness was tested if it could reduce blood glucose levels in patients with gestational diabetes. Before the intervention, there was no significant difference in mean of fasting blood glucose between two groups. After the intervention, mean of fasting blood glucose was 94,79 and 103 mg/dl in the intervention and control group respectively (p-value <0,001) (Kaviani, et al., 2014).

PMR exercises in this study have met the criteria as described by Dharma (2016). The exercise should be continuous, which are given for 25-30 minutes, 3 times daily for 3 consecutive days, rhythmical (it makes the muscles to contract and relax regularly), intensity (it is done alternately between stretching and loosening), progressive/gradually(it is done gradually from a little to a heavy training), and endurance(it restores the cardiovascular system).

Indrayani, Heru, and Agus (2007) also showed that physical exercises had an effect on reducing blood glucose levels in T2DM patients. Insufficient gestures will decrease skeletal muscle movement. Unmoved skeletal muscle will make fat cannot be converted into energy. As a result fat deposits are higher in the walls of blood vessels and skeletal muscles. The accumulation of fat can activate secretion of chemical mediator, leptin. Leptin weakens function decreases amount of insulin receptor. Leptin also reduces binding capacity of insulin receptors with the hormone insulin (Masjur, 2005).

Physical exercises are necessary for DM patients to control blood glucose levels which are foundation of DM management. PMR is one type of exercise that can be performed independently, so patient's self-management will improve. To get maximum results, patients is required to learn about PMR and also be motivated to do the exercises, so they can do it regularly.

This study found that there was a significant decrease of blood glucose levels of T2DM patients in control group (63,80 mg/dl). The decrease in blood glucose levels within control group

because respondents took pharmacological therapy and dietary program in the hospital. Patients took drugs and insulin therapy prescribed by doctor in charge of service (DPJP). Patients' diet was also monitored by nutritionists. When patients regularly follow programmed treatment and diet, it will affect their glucose levels.

Alfian (2015) in his research in Ansari Saleh Regional Public Hospital (RSUD), Banjarmasin revealed that when patients regularly taking medication then their blood glucose levels will drop. In contrast, when patients did not take medication regularly then the patient's blood glucose levels remain high. In research by Tangka, Wiyono and Wati (2015) in Internal Polyclinic of Bethesda General Hospital, Tomohon explained that the dietary compliance in DM patients is very important. Usually, patients should not consume too many sugary foods and should eat on a regular schedule. Dharma (2016) also explained the purpose of controlling food for patients with diabetes mellitus is to maintain the blood glucose levels to stay close to normal by balancing food intake with insulin and physical activities.

When patients are hospitalized, it is very possible to keep the blood glucose at lower levels because patients' diet and medication are closely monitored by health care personnel. However, this condition does not necessarily happen when patients are outside of healthcare facility. Patients should be empowered by give them adequate knowledge and skills to perform diabetes self-management.

This study revealed that PMR that given along with standard treatment could significantly decreases blood glucose level compared to standard treatment alone (p=0,015). Other literature also shows that PMR has an effect in lowering blood glucose levels of patients with DM at Keling 1 Community Health Center (Puskesmas), Jepara (Rusnoto & Diana, 2016). However, the study did not provided detailed explanation about effects of PMR on T1DM, or T2DM, or Gestational Diabetes.

DM patients urgently require some physical exercises because glucose and free fatty acids (FFAs) were processed into energy during the training. Physical exercises could lower blood glucose levels by enhancing carbohydrate metabolism, losing weight and maintaining it in normal condition, and increasing insulin sensitivity (Tarwoto, et al., 2012).

Managing patients holistically needs to be done by training self-care and arranging behavioral changes. DM management includes education, dietary, physical exercise, and medicines. Basically, the DM management starts with diet and then supplemented by sufficient physical exercises (Dharma, 2016). The PMR increase the mobility and the use of muscle that could improve the uptake glucose by the muscle cell. The PMR could be performed even when the patients were in bed, it become one of active range of motion that could performed easily by the hospitalized patients.

During the research, respondents and families were able to understand the instructed PMR techniques well. However, motivation and direction are necessary for the respondents to be able to do the exercises independently and appropriately. PMR is easy to learn and practice in various environments even in hospitals, inexpensive, can be self-studied by respondents or family, and almost do not have any contraindication. Therefore, PMR can be used by nurses as an intervention to reduce glucose levels of patients with T2DM along with standard treatment.

CONCLUSION

The hospitalized T2DM patients were able to practice PMR to lower blood glucose levels. PMR exercises become effective when they are done continuously, rhythmically, intensity, gradually, and having the endurance. Researchers recommend that PMR could be taught to hospitalized T2DM patients. Nurses can apply PMR as an intervention in the management of patients with T2DM along with standard treatment.

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