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Research Article

The Effectiveness of Progressive Muscle Relaxation on Physiological and Psychological Stress Control of Type 2 Diabetes Mellitus Clients in the Mandailing Batak Tribe

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Abstract

Diabetes mellitus is a chronic disease that is always increasing in prevalence in the world. The Mandailing Batak tribe is one of the tribes in North Sumatra. DM clients experience various physiological complaints such as hyperglycemia, hypoglycemia and fatigue. In addition, complaints of discomfort are also one of the problems that occur in diabetics. This study aims to identify progressive muscle relaxation (PMR) in overcoming hyperglycemia, fatigue and discomfort in type 2 diabetes mellitus sufferers of the Mandailing Batak tribe. This research was conducted in Padangsidempuan City from April to July 2020. Quasi-experimental is the design used in this study with a one group pretest-posttest only design. The sampling technique used was purposive sampling with a sample size of 20 people. The instruments used were glucoses, piper fatigue scale, verbal comfort rating scale. PMR can be used as a complementary therapy in reducing hyperglycemia, fatigue and discomfort. The average blood glucose level before the intervention was 293 mg/dl and after 207.65 mg/dl. The average score of fatigue before getting 4.45 and after 2.60. Average discomfort score from 4 to 6. PMR can reduce physiological and psychological stress in type 2 diabetes mellitus sufferers in the Mandailing Batak tribe.

Keywords: Psychological stress; progressive muscle; diabetes mellitus

1. Introduction

Diabetes mellitus or what is called DM is a chronic disease which is a major health problem in the world [1]. The prevalence of DM always increases every year [2]. This number is expected to continue to increase to 629 million by 2045 [3]. WHO estimates that Indonesia in 2030 as many as 21.3 million people will experience diabetes. The results of the 2018 Riskesdas found that the prevalence of DM increased from 6.9% in 2013 to 10.9% in 2015 [4].

The problem that usually occurs in clients with diabetes mellitus is the occurrence of physiological stress and psychological stress [5][6]. Physiological factors include

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hypoglycemia or hyperglycemia, as well as complications from diabetes [7]. This stress is one of the causes of fatigue and discomfort [5]. The quality of life of DM patients can decrease due to fatigue ($p = 0.002$) and functional status ($p = 0.007$) in clients with diabetes mellitus [8].

Diabetes mellitus type 2 is a self-managed disease, which requires both physical and mental energy to complete daily self-management tasks needed to maintain optimal health [9]. Progressive Muscle Relaxation (PMR) is one of the independent nursing actions [10]. Research by Ghazavi et al. found that PMR exercise can reduce HbA1c levels by reducing cortisol secretion so that gluconeogenesis, protein and fat catabolism decreases ($p = 0.036$) [11]. Mashudi stated that PMR can reduce blood sugar levels in clients with T2DM where a significant difference was found (p value 0.003) between the intervention group and the group [12]. In addition, Antoni stated that PMR can reduce symptoms of fatigue and decrease blood glucose in clients with type 2 diabetes mellitus [13].

Besides that, comfort is the outcome of nursing intervention and can be in the form of physical, psychospritual, environmental and social comfort [14]. The Batak tribe is one of the ethnic groups in Indonesia. The Mandailing Batak tribe is one of the tribes in North Sumatra. Based on the research of Purwoningsih (2018), it was found that people with Batak diabetes have bad eating habits (68%), lack of physical activity (74%), and poor sleep quality (86%) [15]. Based on the description above, the researchers are interested in examining the effect of progressive muscle relaxation on the control of physiological and psychological stresses in Batak Mandailing DM patients.

2. Method

This study used a quasi-experimental design in the form of one group pre-test and post test only design. The research site is in the working area of the Padangmatinggi Community Health Center, Padangsidempuan City. Research permit based on letter number 441/5471 / Pusk.PM / VIII / 2020. The population in this study amounted to 190 people. The number of samples is based on the sample size formula $\left\{ \frac{(Z+z)S}{x_1 - x_2} \right\}^2$ so that the total sample size is 20 people. The sample technique used was side-purposing with the respondent's criteria: patients diagnosed with type 2 diabetes mellitus, had the lowest anxiety score of 1, had a minimum fatigue score of 1, and had no cognitive impairment. The measuring instrument used in this study is the Piper Fatigue Scale to measure fatigue (0 = no fatigue, 1-3 = mild fatigue, 4-6 = moderate fatigue, 7-9 = severe fatigue, 10 = very heavy), measured comfort with a comfort verbal rating scale with a

scale of 0-10 (0 = uncomfortable, 10 = highest comfort) and a glucometer to measure blood glucose levels at any time. Progressive muscle relaxation given in 15 steps and given once a day for 3 days. The scores for fatigue, anxiety and blood glucose levels were measured on the first day before the intervention and the third day after the intervention. The data analysis used in this study is the Wilcoxon test on comfort and fatigue. Meanwhile, the blood glucose level used the paired t test.

3. Result

3.1. Blood glucose levels

Based on table 1, it is found that there is a difference in the average score of blood glucose levels before and after progressive muscle relaxation ($p = 0.000$). The difference in the mean before and after the intervention was 25.35 gr / dl.

TABLE 1: Blood glucose levels before and after progressive muscle relaxation (N = 20).

Blood levels	glucose	Mean (gr/dl)	SD	t	P value
Before		293.00	110.285	4.830	0.000
After		207.65	35.171		

3.2. Fatigue scores

Based on table 2, it is found that there is a difference in the average fatigue score before and after progressive muscle relaxation ($p = 0.001$). Before the intervention the fatigue score was 4.45 (moderate fatigue) and after the intervention the fatigue score was 2.60 (mild fatigue). The difference between the mean before and after the intervention was 1.85.

TABLE 2: Fatigue scores before and after progressive muscle relaxation (N = 20).

Fatigue	Mean	SD	P value
Before	4.45	1.317	0.001
After	2.60	1.429	

3.3. Comfort scores

Based on table 3, it is found that there is a difference in the average comfort score before and after progressive muscle relaxation ($p = 0.001$). Before the intervention, the

score of anxiety was 6 and after the intervention the comfort score was 4. The difference in the mean before and after the intervention was 2.20.

TABLE 3: Comfort scores before and after progressive muscle relaxation (N = 20).

Comfort scores	Mean	SD	z	P value
Before	3.10	0.852	-7.678	0.001
After	5.30	1.129		

4. Discussion

Progressive muscle relaxation is effective in dealing with physiological stress in the form of lowering blood glucose scores and the effects of both in the form of decreased fatigue scores and increased comfort. Mashudi suggests that progressive muscle relaxation can reduce blood sugar levels in clients with diabetes mellitus where there is a significant difference (p value 0.003) between the intervention group and the group [12]. The results of Gazavi's study stated that progressive muscle relaxation and massage can reduce HbA1c levels in children with T2DM. This study used a sample of 75 people (25 people with massage therapy, 25 people with PMR and 25 people from the control group) with a p value of 0.036. The results of this study indicate that PMR exercise can reduce HbA1c levels by reducing cortisol secretion so that the process of gluconeogenesis, protein catabolism and fat decreases [11].

This is also in line with Antoni, that progressive muscle relaxation reduces blood glucose levels as well as decreases the accompanying symptoms of hyperglycemia in the form of fatigue [13]. Clients with diabetes mellitus generally have high blood glucose levels, but this blood glucose remains in the bloodstream and does not enter the cells so that it cannot be converted into energy [16]. ATP is a source of energy for muscle contraction for rapid protein synthesis. If ATP is used for continuous contraction, there is depletion of intracellular phosphagen resulting in fatigue. When there is a decrease in the utilization of glucose by the tissues (lack of energy) and anaerobic metabolism that produces less energy and the buildup of lactic acid due to an increase in the concentration of H⁺ ions in the intracellular region. Accumulated lactic acid will build up in muscles and in blood vessels causing H⁺ concentration to increase and pH to decrease. The H⁺ ion blocks the excitation process, which is the decrease in Ca²⁺ that is released from the sarcoplasmic reticulum. The H⁺ ion also interferes with the Ca²⁺ binding capacity of troponin. The H⁺ ion will also inhibit the phospho-fructokinase activity. This lactic acid buildup will make the body feel tired [17][18].

1 Relaxation is a form of manipulative and body-based therapy in complementary and alternative therapies (Complementary and Alternative Therapy (CAM)) [19]. Relaxation is a therapy that can be used to reduce tension in the muscles of the body [20]. Is defined as a tightening and movement movement, relaxes the muscles progressively which is carried out successively on a part of the body at a time to provide a feeling of physical relaxation [20].

The mechanism of action of progressive muscle relaxation in dealing with physiological and psychological stresses in clients with diabetes mellitus is associated with physiological factors, namely hyperglycemia. Progressive muscle relaxation activates the parasympathetic nerves which are then passed to the hypothalamus. Furthermore, the hypothalamus will reduce the stimulation of neurosecretory to release the hormone CRH (Corticotropin Releasing Hormone) to the anterior pituitary, so that the anterior pituitary inhibits the release of the hormone ACTH (Adrenocorticotrophic Hormone) into the circulation. The inhibition of ACTH release will inhibit stimulation of the adrenal cortex to secrete glucocorticoids (cortisol) and in the adrenal medulla which produce catecholamine hormones, especially epineprine and norepineprine [17], [18].

The decrease in the work of epineprin on the pancreas will increase the function of the pancreas in producing insulin so that insulin work will increase. Meanwhile, inhibition of cortisol secretion will have a metabolic effect in the form of increased absorption and use of glucose by many tissues [16], [17]. The inhibition of cortisol also reduces glucose metabolism through gluconeogenesis so that amino acids, lactate, and pyruvate are not converted into blood glucose which will eventually lower blood glucose levels [21]. Decreased gluconeogenesis will decrease anaerobic metabolism resulting in decreased lactic acid buildup that accumulates in muscles and in blood vessels due to a decrease in the concentration of H^+ ions in the intracellularly. This condition will also reduce the symptoms of fatigue experienced [17], [22].

A reduction in physiological stress in the form of hyperglycemia will also reduce fatigue in diabetes mellitus patients [13]. Likewise, the effect of lowering blood glucose levels and reducing fatigue will also have an impact on comfort. Convenience is an impact that arises from the effects of an intervention [14].

5. Conclusion

Progressive muscle relaxation as a nursing intervention can be used to manage physiological stress in the form of hyperglycemia and fatigue and psychological stress which will have an impact on comfort in patients with diabetes mellitus.

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