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The effect progressive muscle of relaxation and micromineral intake (chromium and selenium) on fasting blood sugar levels in type 2 diabetes mellitus

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Abstract
Background: Diabetes mellitus is a metabolic disorder, which is characterized by an increase in blood glucose levels (hyperglycemia) due to relative or absolute deficiency of insulin levels and also due to insulin resistance. The prevalence of diabetes mellitus continues to increase every year which results in an increase in morbidity and mortality. Control of diabetes mellitus is very necessary to prevent complications. Complementary therapies in the form of progressive muscle relaxation (PMR) and micromineral intake can be given in controlling blood sugar levels.
Methods: The type of research used is Quasy Experimental with a research pre-test - post test control group design. This study compiled four groups, namely three groups given treatment and a control group without treatment. Technique non probability sampling with purposive sampling method was used to get 56 respondents divided into 4 groups.
Results: Test results Repeated Measure Anova show values p value 0.001, which means that there are differences in blood sugar levels in each group on day 1, day 8 and day 15.
Conclusion: The results of the study after complementary therapy decreased fasting blood sugar levels in patients who received progressive muscle relaxation and micro mineral intake (chromium and selenium), so that these complementary therapies are effectively implemented for patients who have increased blood sugar levels, especially those with type 2 diabetes mellitus.

Keywords: progressive muscle relaxation, micro mineral intake (chromium and selenium), fasting blood sugar levels, type 2 diabetes mellitus

1. Introduction

Diabetes mellitus is a metabolic disorder disease, which is characterized by an increase in blood glucose levels (hyperglycemia) due to relative or absolute deficiency of insulin levels and also due to insulin resistance [1].

The world Health Organization (WHO) classifies four main types of non-communicable diseases, namely: vascular disease, cancer, chronic respiratory disease and diabetes mellitus. In 2016, an estimated 41 million deaths occurred due to non-communicable diseases. It was found in diabetics that 1.6 million deaths in men have a higher risk before reaching the age of 70 years [2]. According to the International Diabetes Federation (IDF), in 2013 there were 382 million people who had diabetes mellitus. The prevalence in adults aged 20-79 years is predicted to increase to 10.4% in 2040 [3].

In Indonesia the incidence of diabetes mellitus ranks seventh highest in the world and the prevalence of deaths from diabetes is the second highest after Sri Lanka [4]. 1.5% prevalence of diabetes mellitus diagnosed by doctors from the 2013 Basic Health Research. The prevalence of diabetes is higher in people living in cities, having higher education status and in the age range of 56-64 years of 4.8%. The percentage of Indonesian population who have risk factors for central obesity diabetes mellitus is 26.6%, physical activity is less 26.1%, hypertension is 25.8%, cholesterol is 35.9% and diet is not balanced [5]. Data on the Riskesdas in 2018 prevalence of diabetes mellitus increased to 2.0% [6].

Data on Bengkulu Province In 2017 it was found that the number of DM patients was 9,921 [7]. At the Rejang Lebong District Health Office in 2017 there were 912 people with diabetes mellitus.[8] Furthermore, in UPT Curup Health Center data obtained in 2017 the number of patients with diabetes mellitus was 613 people, and in 2018 January to September there were 364 people. As for diabetic prolanis activities onlyrecorded 26 people were [9, 2].

Type diabetes mellitus is caused by insulin resistance. Insulin resistance can occur due to obesity, heart problems, drugs and lack of chromium needed in glucose metabolism and insulin function [10]. Insulin resistance is also caused by a down-regulation mechanism, genetic deficiency / polymorphism from the phosphorylation of insulin receptor tyrosine, IRS protein or PIP-3 kinase and also abnormalities of GLUT-4 function. Patients with type 2 diabetes mellitus can live for several years without showing any symptoms, secretly damaging the function of various organs of the body due to high blood glucose. Therefore it is very critical that efforts can detect, diagnose and also provide treatment services with appropriate access to diabetics [11].

Complications occur because blood glucose levels are uncontrolled and not handled properly. Complications of diabetes are classified as acute and chronic complications. Acute complications occur due to glucose intolerance that lasts for a short period of time, such as hypoglycemia, diabetic ketoacidosis, hyperosmolar hyperglycemic nonketotic syndrome. Chronic complications occur 10-15 years after suffering from diabetes mellitus. Macrovascular complications occur in large blood vessels such as the heart

and brain which result in death and also blockages in large blood vessels in the lower extremities. Whereas microvascular complications occur in small blood vessels such as the kidneys (nephropathy), eyes (retinopathy) which results in blindness. Complications of neuropathic diseases affect sensomotor and autonomic nerves [12].

The aim of the management of type 2 diabetes mellitus is to improve the quality of life of diabetic patients, including improving quality of life, minimizing and even eliminating DM complaints, preventing the risk of acute complications, inhibiting the progress of microangiopathic and macroangiopathic complications and reducing morbidity and mortality [13]. Control of diabetes mellitus is focused on promotive, preventive and rehabilitative efforts. The existing programs in Indonesia are integrated PTM services (PANDU PTM), community-based integrated PTM (Posbindu) development posts, and FULL and INTELLIGENT calls to be implemented by the community [4, 14]. In addition, one of the other government policies in dealing with Type 2 DM disease with the establishment of Prolanis [15]. activities health maintenancefor participants BPJS of consists participants, facilities health and BPJS Health. This activity is for participants who suffer from chronic diseases by financing effective and efficient health services in order to achieve optimal quality of life [16].

Health services provided to DM patients are known as 4 (four) management pillars which include: increasing knowledge through education, increasing physical exercise, medical nutrition therapy, and pharmacology. Education aims to provide patients with an understanding of the course of the disease, management and complications due to diabetes. The principle of medical nutrition therapy is eating balanced foods based on caloric needs and paying attention to schedules, quantities and types of food. Regular physical exercise is carried out for approximately 30 minutes which can reduce weight and increase insulin sensitivity [17].

Pharmacological therapy is given along with other treatments. Pharmacological therapy is usually in the form of oral and injection drugs. Oral antidiabetic drugs such as insulin secretagogue (sulfonylurea, meglitinid, deviret D-phenylalanine), biguanid, thiazolidinedion, and α-glucosidase inhibitors [18]. Non-pharmacological therapy in diabetes mellitus includes medical nutrition therapy, a healthy lifestyle with diet and physical exercise patterns. Foods that are recommended for diabetics are rich in chromium which can improve insulin sensitivity and high antioxidants. Physical exercise can put glucose into cells without the need for insulin. Mild physical exercise is carried out regularly every day at 1 or 1.5 hours after eating [19].

Management of diabetes mellitus is currently not going well. As with surveys in diabetic patients, most say they don't have time to carry out physical exercise. Diet therapy that is currently implemented is only in accordance with the needs of calories (carbohydrates, fats, proteins) without regard to micromineral or trace minerals that the body needs to control blood sugar levels. From several studies, there is still low adherence of diabetics in carrying out pharmacological therapy [20]. And people with diabetes who have diabetes for more than 6 months mostly experience mild to severe stress. Stress will activate the secretion of adrenaline and cortisol which cause hyperglycemia [21].

Complementary therapy can be used as an intervention in the management of diabetes mellitus. One of them is relaxation techniques. Relaxation is a form of mind body therapy which in its management affects the work of the sympathetic and parasympathetic nervous system. The types of relaxation techniques include: progressive muscle relaxation, stretch release relaxation, benson relaxation, autogenic relaxation, breathing exercise, mental imagery, cognitive imagery, diaphragmatic breathing and systemic relaxation [22].

Progressive muscle relaxation can be given to diabetics.exercises Progressive muscle relaxation have effects to reduce muscle tension, reduce stress levels, reduce blood pressure, reduce blood glucose levels, increase tolerance to activity, increase the immune system which has an effect on improving functional status and quality of life.[23] These progressive techniques muscle relaxation are taught to patients by contracting a group of muscles, and then relaxing the muscle contractions. Patients can feel sensations when the muscles are tense and the muscles are relaxed. Thus, the patient can relax his muscles according to his abilities [24]. PMR can reduce blood glucose levels in diabetic patients by affecting glucose metabolism in the muscles, suppressing the release of hormones that can increase blood glucose levels namely epinephrine, cortisol, glucagon, adrenocorticorticotropic hormone (ACTH), corticosteroids and thyroid [25].

Several previous studies have found that progressive muscle relaxation can reduce blood sugar levels. The intervention carried out has not reached the normal limit of <140mg / dL. So it is necessary to do research again with the addition of the intervention time so that the glucose levels of people with diabetes mellitus reach normal limits.

Minerals are substances needed in the body. Minerals affect the metabolic process, so that with good sufficiency can improve homeostasis. One of the trace minerals that can affect blood glucose levels is chromium and selenium. Chromium is influential in the process of carbohydrate metabolism in the body, which functions to increase blood glucose intake into cells. Chromium acts as a cofactor for insulin action in the regulation of glucose in the body by activating GLUT-4 so that the cell can use glucose. Selenium acts as an antioxidant and contributes to regulating cell membrane integrity and decreases the risk of oxidative damage. Selenium can also strengthen phosphorylation of Akt (protein kinase b) and PI3 Kinase which are involved in the process of insulin signaling. PI3 kinase is an important protein in the translocation of GLUT 4 to the cell membrane in muscle cells and adipose [26].

Levels of serum chromium in type 2 diabetes are lower than non-diabetes, this is supported by low chromium intake [27]. From several studies stated that serum chromium levels have the opposite relationship with HbA1c levels. If the level of chromium is good, it can control diabetes mellitus [28].

Micromineral in the form of selenium shows that there is still a lack of adequate intake of patients with type 2 diabetes. The higher the intake of selenium, the lower the fasting blood sugar level of patients [29]. and the relationship between supan zinc and selenium with HbA1c levels in patients with Type 2 diabetes mellitus. Diits with zinc and selenium intake are very necessary in the regulation of T2DM patients [30].

Management and control of diabetes mellitus at the Curup Health Center UPT in Rejang Lebong Regency there has been no progressive muscle relaxation and micromineral

intake (chromium and selenium) management.
Based on the description above, there is a need for further research on progressive muscle relaxation and micromineral intake (chromium and selenium) on fasting blood sugar levels in type 2 diabetes mellitus.

2. Methods

This type of research uses research Quasy Experimental with pre test - post test with control group. The researchers compiled four groups, namely the group giventreatment progressive muscle relaxation, the group given treatment of micromineral intake (chromium and selenium), the combination group progressive muscle relaxation and micromineral intake (chromium and selenium) then the control group without being given both treatments. Provision of therapy was progressive muscle relaxation given twice with a duration of 30 minutes and giving micromineral intake (chromium 25-35 µg/day and selenium 40-45 µg/day) for 14 days. The measurement of fasting blood sugar levels of respondents was examined using a spectrophotometer instrument by taking respondent's venous blood by the UPT Curup Health Center. Examination of fasting blood sugar levels is carried out before and after the action of the therapy.
The population in this study were all people with diabetes mellitus in Rejang Lebong District who were registered for treatment in the UPT Curup Health Center Rejang Lebong working area in January - September 2018. Determination of the minimum number of samples using atechnique sampling non probability with purposive sampling method and based on inclusion and exclusion criteria as many as 56 respondents divided into four groups with each of the 14 respondents inprogressive muscle relaxation 14 respondents, group two (micromineral intake) 14 respondents, group three (combination progressive muscle relaxation with micromineral intake) 14 respondents and a control group of 14 respondents.
In this study researchers conducted data collection by observing, identifying, interviewing and filling out the questionnaire. The collected data was analyzed through the IBM SPSS program version 24.0, and continued with different tests namely parametric tests (Repeated Measure Anova and post-hoc paired wise comparation). The processed data is used as the basis for discussing problem statements, which are then presented in table form so conclusions can be drawn.

3. Results

Table 1: Frequency distribution of respondents based on age, sex, education and occupation based on demofigic data

Characteristics	PMR	Micromineral	Combination of	Control	Total	p value*
	f (%)	f (%)	f (%)	f (%)	f (%)	
Gender						
Male	6 (42.9)	6 (42.9)	4 (28.6)	6 (42.9)	22 (39.3)	0.781
Female	8 (57.1)	8 (57.1)	10 (71.4)	8 (57.1)	34 (60.7)	
Education						
Low	4 (28.6)	5 (35.7)	8 (57.1)	5 (14.3)	22 (39.3)	0.530
Height	10 (71.4)	9 (64.3)	6 (42.9)	9 (85.7)	34 (60.7)	
Employment						
does not work	4 (28.6)	6 (42.9)	8 (57.1)	4 (28.6)	22 (39.3)	0.827
Farmers	2 (14.4)	3 (21.4)	1 (7.1)	1 (7.1)	7 (12.5)	
Private	5 (35.7)	2 (14.3)	3 (21.4)	2 (14.3)	12 (21.4)	
Civil Servants	3 (21.4)	3 (21.4)	2 (14.3)	7 (50)	15 (26.8)	
Variables	Mean / SD	Mean /SD	Mean /SD	Mean / SD	Mean / SD	p-value
Age	46.93 / 5.015	49.00 /2.935	50.00 /3.802	49.29 / 4.514	48.80/4.188	0.075

*Test Homogeneous

Respondent characteristic frequency distribution data are shown in table 1 above, that the characteristics of respondents from the type of Kela min the majority of respondents suffering from type 2 diabetes mellitus were women (60.7%) and men (39.3%) with a p-value of 0.781. Education of respondents had higher education (60.7%) and lower (39.3%) p-value of 0.530. While the type of work of the respondents is mostly not working (39.3%) and the least farmer (12.5%) with a p-value of 0.827. Then the mean characteristics of respondents in the intervention group PMR was 46.93 years and the average control group of respondents was 49.29 years with each variable having the same or homogeneous p value > 0.05.

Table 2: Differences in Day 1, 8th and 15th Day Fasting Blood Sugar Levels in the PMR Group, Micromineral Intake (Chromium and Selenium), Combinations and Controls.

Group	Fasting Blood Sugar			F	p-value
	Day 1 Mean±SD	Day 8 Mean±SD	Day 15 Mean±SD		
PMR	186.07±10.716	165.71±10.156	150.14±15.208	51.23	<0.0001
Microminerals	178.43±9,346	168.43±15.052	145.79±16.320	108.45	<0.0001
Combination	178.29±7.054	161.43±7.325	132.43±9.436	216.52	<0.0001
Control	178.57±8.281	178.64±6.440	166.64±12.628	7.44	0.027
p-value	0.065	<0.0001	<0.0001		

*Test Repeated Measure ANOVA

From the table above, describe the differences in sugar fasting blood statistically p value <0.05 so it can be concluded that there are differences in blood sugar levels in each group on day 1, day 8 and day 15. The results of the intergroup statistical test on day 1 blood sugar levels showed p value> 0.005, there was no difference between the PMR group, micromineral intake, combination and control. On the 8th day and 15th day showed a p value <0.005. It can be concluded that there was a difference in blood sugar levels in each group.

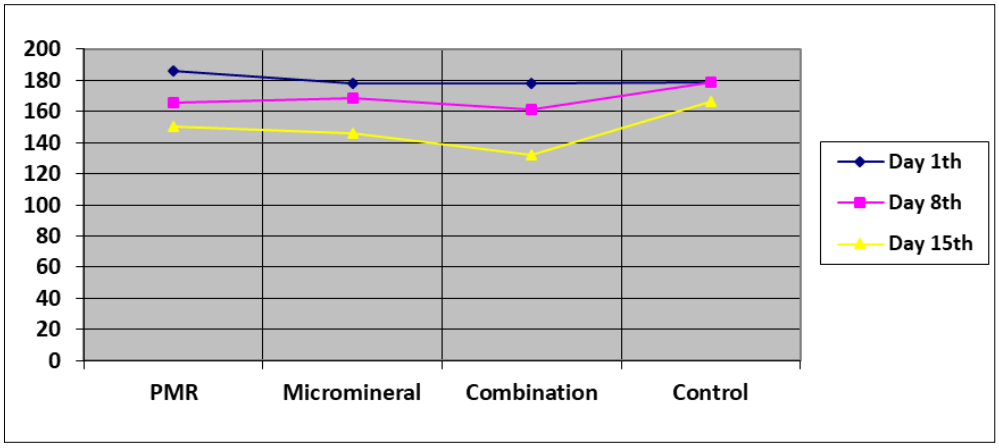

Fig 1: Description of the Decrease of Fasting Blood Sugar in the Intervention and Control Group

The decrease in fasting blood sugar levels in fig 1 shows that the combination group PMR and micromineral intake were more effective on the 15th day.

Table 3: Differences in Delta Mean Fasting Blood Sugar Levels Day 1, Day 8, and Day 15 In PMR Group, Micromineral Intake (Chromium and Selenium), Combination andControl

Group	Δ MeanFasting Blood Sugar Level			p-value
	Day 1th vs. Day 8th	Day 1th vs. Day 15th	Day 8th vs. Day 15th	
PMR	20.4	35.9	15.6	<0.0001
	(10.1-30.6)	(24.1-47.8)	(9.16-21.9)	
p-value	<0.0001	<0.0001	<0.0001	
Mikromineral	10.0	32.6	22.6	<0.0001
	(3.2-16.9)	(25.7-39.6)	(18.0-27.3)	
p-value	0.004	< 0.0001	< 0.0001	
Combined	16.9	45.9	29.0	<0.0001
	(12.1-21.6)	(38.2-53.5)	(23.5-34.5)	
p-value	<0.0001	<0.0001	<0.0001	
Control	-0.1	11.9	12.0	0.027
	(-7.7-7.6)	(1.6-22.3)	(0.8-23.2)	
p-value	1.000	0.034	0.022	

*Post-hoc paired wise comparation test

Table 3 above, shows a p value <0.05 for each comparison, which means that differences are obtained in all measurements.

5. Discussion

5.1 The Effects of Progressive Muscle Ralaxation on Fasting Blood Sugar Levels in Type 2 Diabetes Mellitus

The results showed that the provision of progressive muscle relaxation proved to have an effect on reducing fasting blood sugar levels. Changes in fasting blood sugar levels, seen from the results of the analysis of the mean value before treatment of 186.07 mg / dL after 14 days of intervention, mean values changed to 150.14 mg/dL with a mean difference of 35.93 mg/dL with a p-value <0.001. It was concluded that it can reduce fasting blood sugar levels even though it is not within normal limits.

The results oftest paired wise comparation showed that the average difference in decline occurred on day 1 to day 8 of 20.4 mg/dL. While the average decrease in the 8th day to the 15th day is 15.6 mg/dL.

The results of this study can be concluded that progressive muscle relaxation 2 times a day with a duration of 30 minutes for 14 days affects fasting blood sugar levels in type 2 diabetes mellitus. This study is in line with Casman's study (2015) the influence of progressive muscle relaxation on fasting blood sugar levels with a p value of 0.000 [31]. And Mashudi's research (2011) states that PMR can reduce blood sugar levels [32].

The movement of progressive muscle relaxation aims to increase the need for glucose by activating muscle movement, so that glucose in the blood can be used as energy. PMR is one of complementary therapies in the form of mind-body therapy that combines physical and psychological. PMR can reduce blood sugar levels in patients with DM by raising a relaxed state in this condition there is a decrease in nerve impulses in the efferent pathway to the brain where activation becomes inhibition. This change in nerve impulses causes a feeling of calm both physically and mentally [22].

Some things that can affect blood sugar levels such as stress levels. In this study the researchers did not measure the

stress level of the respondents.

5.2 The Effect of Micromineral Intake (Chromium and Selenium) on Fasting Blood Sugar Levels in Type 2 Diabetes Mellitus

The results showed that micromineral (chromium and selenium) intake was shown to have an effect on reducing fasting blood sugar levels. Changes in fasting blood sugar levels were seen from the results of the analysis of the mean value before treatment, which was 178.43 mg/dL after an intervention for 14 days the mean value changed to 145.79 mg / dL. Micromineral intake (chromium and selenium) can reduce fasting blood sugar levels but has not reached the normal limit.

The results of thetest paired wise comparation showed that the average difference in decline occurred on the 8th to 15th day of 22.6 mg / dL. While the average decline of day 1 to day 8 is 10.0 mg/dL.

The results of this study can be concluded that micromineral intake (25-35µg chromium and selenium 40-45µg) for 14 days affected fasting blood sugar levels in type 2 diabetes mellitus.

Diabetes due to insulin resistance is caused by GLUT-4 which is not optimal in helping glucose uptake into the cell. Chromium has the opposite relationship with insulin resistance. Chromium increases the activation of insulin kinase receptors and blocks phosphatase. Enzymes that work to break down phosphates from insulin receptors resulting in decreased insulin sensitivity [28].

Selenium contains the glutathione peroxide enzyme which acts as a catalyst in the breakdown of peroxide formed in the body into bonds that are not toxic. Peroxide turns into free radicals which can oxidize the unsaturated fatty acids in cell membranes and damage the cell membrane. Selenium participates in an enzyme system that prevents the occurrence of free radicals by reducing the concentration of peroxide in cells [33].

Intake of food consumed by people with diabetes mellitus can also affect blood sugar levels. In Indonesia there is no data on the value of chromium and selenium in the list of food ingredients (DKBM). So that researchers could not measure the intake of chromium and selenium consumed by food by respondents.

This study is in line with Jablonska's study (2016) which states that consumption of selenium can reduce HbA1c, a sign of blood glucose. This proves that selenium is involved in glucose metabolism [34].

The results of the Sutiari study (2017) show that there is a tendency for CrPr supplements to reduce HbA1c levels and GDP of people with T2DM. CRPr supplements tend to increase insulin levels and fasting serum adiponectin in DMT2 subjects [35].

5.3 The Effects Progressive Muscle of Relaxation and Micromineral Intake (Chromium and Selenium) on Fasting Blood Sugar Levels in Type 2 Diabetes Mellitus

The results showed that progressive muscle relaxation and micromineral intake (chromium and selenium) were shown to influence fasting blood sugar levels. Changes in fasting blood sugar levels were seen from the results of the analysis of the mean value before treatment, namely 178.29 mg / dL after an intervention for 14 days the mean value changed to 132.43 mg / dL. Decreasing fasting blood sugar levels is not yet within normal limits.

The results of thetest paired wise comparation showed that the average difference in decline occurred on the 8th to 15th day of 29.0 mg / dL. While the average decrease in day 1 to day 8 is 16.9 mg/dL.

The results of this study can be concluded that progressive muscle relaxation 2 times a day with 30 minutes duration and micromineral intake (25-35µg chromium and 40-45µg selenium) for 14 days affect fasting blood sugar levels in type 2 diabetes mellitus.

Progressive muscle relaxation provides tension in a group and stop the tension then focus on the muscle to relax, feel a relaxed sensation and the tension disappears. This exercise will make the body relax. The parasympathetic system will stimulate the hypothalamus to reduce the secretion of corticotrophin releasing hormone (CRH), a decrease in CRH will affect the secretion of adrenocorticotropic hormone (ACTH) This condition can inhibit the adrenal cortex from releasing the hormone cortisol. Decreased cortisol hormone will inhibit gluconeogenesis and can increase glucose usage by cells [22]. Relaxation therapy can inhibit the secretion of noreepineprin which causes a decrease in heart, breathing and glucose in the blood [36].

Selenium has a complex effect on the human body including antioxidants, anti-inflammation and plays a role in the body's immunological system. Selenium functions in the human body binds to protein, which is called selenoprotein. The important selenoprotein is glutathione peroxidase. which will fight oxidative stress in the body through blocking pancreatic β cell damage. In humans the selenoprotein circulation will be related to fasting plasma glucose levels [37].

6. Conclusion

Based on the results of research on the provision of progressive muscle relaxation and micromineral intake with respect to fasting blood sugar levels in type 2 diabetes mellitus patients, the following conclusions can be drawn :

a. Progressive muscle relaxation for 2 times 30 minutes duration for 14 days influences the 8th day fasting blood sugar level 20.4 mg/dL, 15th day 35.9 mg/dL.
b. Micromineral intake (chromium 25-35µg and selenium 40-45 µg) for 14 days had an effect on reducing the 8th day fasting blood sugar level 10.0 mg/dL, day 15 32.6 mg/dL.
c. Combination Progressive muscle relaxation for 2 times duration of 30 minutes and micromineral intake (chromium 25-35µg and selenium 40-45 µg) for 14 days had an effect on reducing fasting blood sugar levels on day 8 of 16.9 mg/dL, day 15 of 45.9 mg/dL

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