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No. Pemeriksaan : 2023.06.21.387

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<https://doi.org/10.53730/ijhs.v6nS4.11248>

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Reducing blood glucose levels in the elderly with diabetes mellitus using ergonomic exercise based on spiritual care

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Abstract--The increasing number of people with diabetes has an impact on the global burden of diabetes mellitus (DM) becoming a major public health priority, placing unsustainable demands on individuals, their guardians, economies, health systems and society. The increase in the number of DM is influenced by the increase in the prevalence of obesity and unhealthy behaviors including poor diet and physical activity. In reducing the morbidity rate, there needs to be an effort to control blood glucose levels, one of which is ergonomic exercise based on spiritual care. The purpose of this study was to determine the effect of ergonomic exercise based on spiritual care on blood glucose in the elderly with diabetes mellitus. The design of this study used a quasi-experimental with a control group. The population of this study were all elderly people with diabetes mellitus. The sample of this study was 104 respondents, divided into 52 intervention groups and 52 control groups. This research instrument uses an

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International Journal of Health Sciences ISSN 2550-6978 E-ISSN 2550-696X © 2022.

Manuscript submitted: 27 April 2022, Manuscript revised: 9 June 2022, Accepted for publication: 18 July 2022

6650

observation sheet. This research was conducted in April - June 2022. The results of this study obtained an average blood glucose level in the intervention group 2.69 and in the control group 2.70 with p value = 0.957. the average blood glucose level in the intervention group was 1.37 and in the control group 2.81 with p value = 0.000. In this study, it was found that there was an effect of ergonomic exercise based on spiritual care for reducing blood glucose levels. So that ergonomic exercise based spiritual care can be used as a non-pharmacological therapy for nurses and can be applied independently by people with diabetes mellitus.

Keywords---diabetes mellitus, elderly, ergonomic exercise, spiritual care.

Introduction

The frequency of occurrence of non-communicable diseases in the community is increasing and is a concern (World Health Organization, 2023). One of the non-communicable diseases (NCD) is Diabetes Mellitus (DM). Diabetes Mellitus is a heterogeneous group of disorders characterized by an increase in glucose in the blood (hyperglycemia) that occurs due to a decrease in the body's ability to respond to insulin and a decrease or failure of the pancreas to produce insulin (Beverly EA., et al. 2014). The increasing burden of diabetes mellitus (DM) globally is becoming a major public health priority, placing unsustainable demands on individuals, their guardians, health systems and society. The increase in DM rates is influenced by the increase in the prevalence of obesity and unhealthy behaviors including poor diet and physical activity (Forouhi & Wareham, 2019). Recent estimates suggest that there was a global prevalence of 425 million people with diabetes in 2017, which is expected to increase to 629 million by 2045 (Forouhi & Wareham, 2019). The prevalence of DM patients in Indonesia has increased from 5.8 million in 2013 to 10.3 million in 2018 (RIKESDAS, 2018).

Old age is something that will be able to be owned by every individual as maturity. The elderly will face different physical, biological, mental and financial problems. Information on the level of elderly or elderly in Indonesia in 2017, there are three regions with the highest levels of elderly, namely the Unique District of Yogyakarta 13.81 percent, Central Java 12.59 percent and East Java 12.25 percent. The region with the smallest number or level of elderly is Papua with a level of 3.20%, West Papua 4.33% and Riau Islands 4.35% (Kementerian Kesehatan RI, 2018). Elderly or elderly will experience various problems in the body such as infectious and non-communicable diseases. One of the diseases that are often experienced by the elderly is non-communicable diseases such as Diabetes Mellitus.

If not treated properly, Diabetes Mellitus can lead to various complications, including acute and chronic complications. Diabetes Mellitus is a disease with long treatment and even a lifetime, the treatment is not only in health facilities, but continues at home and requires help from the family. If not handled properly can be risky or very dangerous. In people with Diabetes Mellitus that must be

considered is controlling blood sugar levels, because it can have a bad impact. If the blood sugar level is too high or the patient's blood sugar level is less than normal, both can cause life-threatening complications. Diseases that will be caused include impaired eye vision, cataracts, heart disease, kidney disease, sexual impotence, wounds that are difficult to heal and rot/gangrene, lung infections, blood vessel disorders, stroke and so on. For this reason, so that the blood sugar of people with Diabetes Mellitus can be well controlled, it is necessary to apply the five pillars of Diabetes Mellitus (Nurhidayati et al, 2019).

In Indonesia, the program for implementing the five pillars of Diabetes Mellitus has been implemented since 2011. However, the implementation has not been optimal because patients find it difficult to do so with lifelong disease conditions, sometimes boredom arises in undergoing treatment and bored with various rules related to the management of Diabetes Mellitus (Pardi, 2017). Proper handling of diabetes mellitus is very necessary. Handling Diabetes Mellitus can be grouped into five pillars, namely: Education, meal planning, physical exercise, pharmacological interventions and blood sugar checks. The management of the 5 pillars of Diabetes Mellitus can be carried out well if patient has a good attitude. Attitude will affect someone in doing something. When the patient has a positive attitude it will make it easier for the patient to take an action and vice versa if the patient has a negative attitude it will make it difficult for the patient to take an action. When the attitude of people with Diabetes Mellitus is willing to implement the five pillars of Diabetes Mellitus with the absorption of good education, appropriate eating arrangements, regular exercise, adherence to medication and diligently checking blood sugar at the nearest health facility, it will have an impact on stabilizing blood glucose and improving the quality of life of people with diabetes. Mellitus (Eva KW., 2019).

Physical exercise is a very important way to be done by people with diabetes mellitus, especially in dealing with increased glucose in the blood. One of the recommended exercises is ergonomic gymnastics (Sinaga, 2012). Physical exercise such as ergonomic exercise will reduce blood glucose levels by increasing glucose uptake by muscles and improving insulin use and improving blood circulation (Wratsongko, 2014). Ergonomic exercise is a combination of muscle movement and breathing. Ergonomic exercise can reduce blood sugar levels because when doing ergonomic exercise, the muscles are moved optimally so that they absorb more blood sugar for the burning process. The benefits of ergonomic exercise in patients with diabetes mellitus reach all aspects including controlling blood glucose, improving insulin use, increasing and facilitating blood circulation and preventing complications (Wratsongko, 2014). Ergonomic exercise is one of the interventions to reduce blood sugar levels in people with diabetes mellitus as an alternative non-pharmacological treatment.

Based on previous research by Fahmi GZ and Widiyatmoko A (2013) concerning the Effect of Ergonomic Gymnastics in Patients with Type 2 DM on Fasting Blood Glucose Levels and 2 Hour Postprandial Glucose Levels, it was found that the average difference between fasting blood glucose levels and 2 hours postprandial blood glucose levels showed significant differences. not significant ($p > 0.05$) between the intervention group and the control group. So in this study the researchers wanted to add spiritual care aspects in ergonomic exercise in

reducing blood glucose levels in the elderly with diabetes mellitus. Spiritual care is a process that has the potential to heal, by fulfilling spiritual needs. Many believers believe that God Most High always understands his servants, ultimately meeting spiritual needs through people (Lycett D and Riya Patel, 2022).

Method

The research design used is a quasi-experimental quantitative research by providing intervention to the research subject. Furthermore, the effect of the intervention was measured and analyzed using pre-test and post-test research designs with control group design. The subjects of the study were the elderly with type 2 diabetes mellitus in the Surabaya area. The population of this study were all elderly people with diabetes mellitus. The sampling technique in this study used purposive sampling by looking at the inclusion and exclusion criteria, it was found that 104 respondents. The inclusion criteria of this study were patients with type 2 diabetes who underwent routine treatment and has been diagnosed with diabetes mellitus by a doctor, were willing to participate in the study until the end, willing not to take antidiabetic drugs during the study and resided in the Surabaya area. The exclusion criteria for this study were patients who had complications from severe DM, patients with cardiovascular disorders, stroke patients, and elderly people with dementia.

The independent variable in this study was ergonomic exercise. The instrument used for the independent variable is Standard Operating Procedure. The dependent variable for this study was blood sugar levels. The measuring instruments used for the dependent variable are Autocheck and observation sheets.

In this study, they were divided into 2 groups, namely the intervention group who were given therapy in the form of ergonomic exercise based on spiritual care 3 times a week and carried out for 4 weeks with a duration of 15-20 minutes. For the control group, it was given according to the Posyandu Elderly program for the elderly in Surabaya, namely elderly gymnastics once a week. This research was conducted in April - June 2022.

Guidelines for the Implementation of Spiritual Care-Based Ergonomic Exercise as follows (Wratsongko, 2014; Hasina et al, 2020) :

1. Opening movement, standing perfectly, breathing arranged in a relaxed manner so that all nerves become one point in controlling the brain.
2. The takbiratul ikhram movement, this movement is like an airy movement which means that as a human being, you have to accept the reality of life and be patient.
3. The bowing movement, this movement is like a gesture of submission to gratitude, which means that apart from being grateful to Allah, as humans, we must always respect and respect each other.
4. The prostration movement, a movement that is derived from the mighty sitting movement, which means that humans must submit and humble themselves to Allah SWT.

5. The prayer movement sits between two prostrations, this movement is called a burning movement which symbolizes peace of mind.
6. The motion of lying down in surrender, this movement throws arrogance, makes sincerity in the heart, surrenders oneself to Allah SWT. This last movement as the peak of relaxation of the body from physical and mental tension.

The results of the study were analyzed statistically using paired t test and independent t test. The difference was considered significant if $p < 0.05$. The results obtained from the statistical test were then analyzed to answer research problems and hypotheses. This research has passed the ethics of the Research Ethics Committee of the Brahmanda Lentera Chakra Institute No. 005/007/IV/EC/KEPK/Lemb.Candle/2022.

Discussion

Results in this study are shown at this table

Table 1
Demographic of respondents

Demographic Data of Respondents	Groups			
	Group 1 (Intervention) (N=52)		Group 2 (control) (N=52)	
	F	%	F	%
Age				
45-54 years	5	9.6	8	15.4
55-65 years	18	34.6	15	28.8
66-74 years	27	51.9	28	53.9
75-90 years	2	3.9	1	1.9
Gender				
Male	17	32.7	15	28.8
Female	35	67.3	37	71.2
Profession				
Working	24	46.2	23	44.3
Not working	28	53.8	29	55.7

7 Table 2
Blood glucose levels in the intervention group and the control group before being given the intervention

Group	Mean	SD	Min	Max	SE Mean	p value
Intervention	2.69	34.3	208	345	4.768	0.957
Control	2.70	35.0	207	354	4.854	

7 Table 3
Blood glucose levels in the intervention group and the control group after being given the intervention

Group	Mean	SD	Min	Max	SE Mean	p value
Intervention	1.37	34.3	98	214	4.709	0.000
Control	2.81	35.0	232	354	4.933	

Table 4
Blood glucose levels (pretest and posttest) in the intervention group and control group (N=52; N=52)

Groups		Mean	SD	t	p value
Intervention	Pre	2.69	34.38	27.53	0,000
	Post	1.37	33.96		
Control	Pre	2.70	35.00	-3.600	0,001
	Post	2.81	35.81		

Diabetes Mellitus (DM) is a heterogeneous group of disorders characterized by elevated blood glucose levels or hyperglycemia (>200 mg/dL). Sugar that is processed in the body is used as energy. In the process of energy formation, sugar will be processed in the cells with the help of insulin, while insulin in the body is produced in the pancreas. Weakened organs will experience decreased function, including pancreatic cells in charge of producing insulin. Pancreatic cells can degenerate, causing too little insulin to be produced so that blood glucose levels increase. Ergonomic gymnastics is where the movement according to the arrangement of body functions. The body will function normally and will remain in good health. This movement can also control, prevent some disorders in the body so that it remains healthy and fit. (Sagiran , 2012). There are several causes related to diabetes, namely age, gender, marital status, education level, job level, socioeconomic conditions, suffering from chronic diseases, social support, biological factors and psychological factors (Denton et al, 2004; Megari, 2013).

Based on table 1, it is found that most people with diabetes mellitus are aged 66-74 years in the young old category. The gender of diabetics in this study were mostly women and some of them did not work. Based on basic health research data in 2013, nationally the prevalence of DM according to gender characteristics with age 60 years and over in women tends to be higher than men. This theory supports the results of research that most of those who suffer from blood sugar levels are female. Based on Table 2, the average blood glucose level in the intervention group was 2.69 and in the control group 2.70 with p value = 0.957 meaning that there was no difference in the average blood glucose level in the intervention group and the control group before being given the intervention.

Table 3 shows that the average blood glucose level in the intervention group is 1.37 and in the control group is 2.81 with p value = 0.000 meaning that there is a difference in the average blood glucose level in the intervention group and the control group after being given the intervention. In the intervention group, ergonomic exercise activities are very beneficial for the management of diabetes mellitus. Because when physical activity (exercise) insulin resistance decreases,

when a person does physical exercise, the body will increase the need for body fuel by active muscles and complex body reactions occur including circulation, metabolism and autonomic nervous system functions. Where glucose is stored in the muscles and liver as glycogen, glycogen is quickly accessed to be used as an energy source in physical exercise. If the exercise continues for more than 20 minutes, the main energy source becomes free fatty acids derived from lipolysis of adipose tissue. The availability of glucose and free fatty acids is regulated by various hormones, especially insulin, as well as catecholamines, cortisol, glucagon, and growth hormone (GH). During physical exercise the secretion of glucagon increases, as well as catecholamines to increase glycogenolysis, but also cortisol which increases protein catabolism, releasing amino acids that are used in gluconeogenesis. All ¹⁶ these mechanisms lead to increased blood glucose levels. In DM, physical exercise plays ¹⁶ major role in regulating blood glucose levels. The main problem in DM is the lack of response to insulin (insulin resistance). The presence of these disorders causes insulin can't help transfer glucose into cells. Membrane permeability increases in contracting muscles so that during ¹ physical exercise insulin resistance decreases while insulin sensitivity increases. physical exercise will reduce blood glucose levels by increasing glucose uptake by muscles and improving insulin use and improving blood circulation (Wratsongko, 2015).

The decrease in respondents' blood sugar levels is also influenced by good and regular exercise in the form of spiritual care-based ergonomic exercises. Ergonomic gymnastics itself is a fundamental exercise whose movements are in accordance with the physiological functions of the body and the movements are very simple. Every movement in this ergonomic exercise will relax the body and move the muscles optimally so that they absorb ¹⁰re blood sugar for the burning process. Doing ergonomic exercises regularly, at least 2-3 times a week \pm 20 minutes if all movements are done perfectly (Ariani et al, 20¹⁸, Jerau et al, 2016). Ergonomic exercise based on spiritual care performed by people with diabetes mellitus will affect their blood sugar levels. Increased use of glucose by muscles will increase when a person does high physical activity. This is because endogenous glucose will be increased to keep blood sugar levels in balance. Under normal circumstances, the balance of blood sugar levels can be achieved by various mechanisms of the nervous system, glucose regulation and hormonal conditions. Another theory states that physical activity is directly related to the speed of recovery of muscle blood sugar. When physical activity is carried out, the muscles in the body will react by using the stored glucose so that the stored glucose will decrease. In these circumstances there will be a muscle reaction in which the muscles will take up glucose in the blood so that glucose in the blood decreases and this can improve blood sugar control. These activities include gymnastics, walking, work. Nurayati, et al (2017). In this study, spiritual care points are added so that getting closer to God can provide comfort in dealing with the pressures of life and can provide conditions accompanied by hope, which can provide protection against a problem, especially diabetes (Imeni et al, 2018; Akbari et al, 2020).

¹⁰

Based on table 4 that the results of the Paired T-Test statistic ¹⁹l test, $p = 0.000$ in the intervention group and $p = 0.001$ in the control group, p value < 0.05 , it can be concluded that there is a significant change in blood glucose levels before and

after the intervention. spiritual care-based ergonomic exercise in the intervention group and the control group who were only given exercise for the elderly. With spiritual care-based ergonomic exercise, it activates insulin binding and insulin receptors in the plasma membrane so that it can reduce blood glucose levels. The benefits of physical exercise are lowering blood glucose levels by increasing glucose uptake by muscles and improving insulin use, improving blood circulation and muscle tone, changing blood fat levels, namely increasing HDL cholesterol levels and reducing total cholesterol and triglyceride levels (Wratsongko, 2015).

Conclusion

In this study, it was found that there was an effect of ergonomic exercise based on spiritual care for reducing blood glucose levels. So that ergonomic exercise based spiritual care can be used as a non-pharmacological therapy for nurses and can be applied independently by people with diabetes mellitus.

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