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The Effectiveness of Acupressure Pen and Active Stretching *(Acupenas)* on Fasting Blood Sugar Levels among Type 2 Diabetes Mellitus Patients

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Abstract. International Diabetes Federation (IDF) reported that the number of DM patients worldwide increases every year. Indonesia ranks sixth with the highest DM prevalence globally after China, India, the United States, Brazil, and Mexico. The main problem caused by DM patients is the instability of blood sugar levels. Alternative treatments for Diabetes Mellitus with complementary therapy are acupressure therapy, which can prevent complications and improve blood sugar levels. This study examines the effectiveness of acupressure pen and active stretching on fasting blood sugar levels in type 2 diabetes mellitus patients. This true research experiment with the design using pre-test and post-test control group design. Data collection involved 38 respondents of type 2 Diabetes Mellitus patients, selected through technique probability sampling with simple random sampling. The intervention group was received the acupressure pen and active stretching *(Acupenas)* therapy with metformin drug 2x500 mg. In contrast, the control group only received therapy metformin drug 2x500 mg without acupressure pen and active stretching. Independent t-test results showed significant differences with the average fasting blood sugar levels p-value 0.002 (<0.05). It was indicated that the intervention group is better at lowering blood sugar levels than the control group seen from the higher difference value. Complementary therapy is acupressure pen and active stretching was effective in reducing blood sugar levels in type 2 Diabetes Mellitus patients.

Keyword: Acupressure pen, active stretching, blood sugar levels, type 2 diabetes mellitus.

INTRODUCTION

Diabetes Mellitus (DM) is a metabolic disorder caused by impaired insulin secretion or insulin resistance in the body that can increase blood glucose levels beyond the standard limit (1). DM is one of the non-communicable diseases whose numbers continue to grow every year(2).

Data from the International Diabetes Federation (IDF), the number of DM patients worldwide increases every year. In 2015 there were 415 million people, and it is predicted that in 2040 it will increase to 642 million people. Indonesia ranks sixth with the highest DM prevalence globally after China, India, the United States, Brazil, and Mexico. In the Southeast Asian regional region, which consists of 11 member countries, adults with Diabetes with an age range of 20-70 years totaling 10.3 million or 6.2% in 2017. It is estimated that in 2045 will increase to 16.7 million or 7.4% (3).

Basic health research data (2018), the number of DM patients in 2013 was 6.9%, and in 2018 it increased to 10.9%. It was predicted that there would be an increase in the number of DM patients by 21.3 million in 2030. Figures DM patients in Bengkulu Province in 2018 were 19,353 people (4). From the results of a preliminary study in UPTD Hospital Argamakmur North Bengkulu district. It was found that the prevalence of DM patients in 2018 was 1,127 people, then from 2019 medical record data, there was an increase with 1,439 people with total DM patient visits totaling ±100 people each month(5).

Type 2 DM is a disease caused by damage to a person's body cells due to the inability to use insulin. And other causes due to a person's body that cannot respond or decrease the sensitivity of the target tissue to the effects of insulin metabolism. This is called insulin resistance or also called Non-Insulin Dependent Diabetes Mellitus (NIDDM) (1).

The main problem caused by DM patients is the instability of blood sugar levels. The Indonesian Endocrinology Association (PERKENI) concluded that the diagnosis criteria for DM are fasting blood sugar levels ≥126 mg/dl and blood sugar at ≥200 mg/dl (6). Increasing blood glucose levels would potentially damage blood vessels, nerves, and internal structures. If this problem does not get the right treatment, then it tends to cause the metabolism of nutrients, fats, and proteins disturbed. DM patients have the potential to suffer various complications, both acute and chronic. Acute complications include hypoglycemia coma, ketoacidosis, and non-ketotic hyperosmolar coma. At the same time, chronic complications are in the form of macroangiopathy and microangiopathy. Neuropathy is a disorder of the sensory and motor nervous system and autonomic to the feet and peripheral blood flow. Neuropathy begins with a sign of decreased foot sensitivity, which can increase the high risk of complications from diabetic ulcers until the disability ends (amputation) (7).

PERKENI 2015 states that DM disease management consists of 5 pillars: education, medical nutrition therapy, pharmacology, physical exercise, and blood sugar monitoring (7). Management of Diabetes mellitus can be done with non-pharmacological treatment and pharmacological treatment. Non-pharmacological management includes education, weight control, physical exercise, monitoring dietary blood sugar, and foot care. Pharmacological treatment in the form of administration of insulin and oral hypoglycemic drugs. The therapy is given if the therapy is non-pharmacologic unable to control blood glucose levels, and is run by not leaving treatment pharmacological, which has been applied earlier. Still, the management of pharmacology in the long term will affect the health of other organs, especially kidneys as the filter body(8).

The complementary strategies used to prevent complications, including praying, listening to classical music, acupressure, inhaling aromatherapy, stretching, gymnastics, yoga, and others. Acupressure therapy is an additional therapy that has been combined by nursing staff who have been listed in the Nursing Interventions Classification (NIC) (9).

Acupressure is a traditional medical technique from China that has been believed to help cure diseases derived from the science of acupuncture. Acupressure is a term.

commonly used to provide stimulation at acupoints using fingers or tools with emphasis. Acupressure is performed at points ST.36, ST.40, LV.3, and SP.6.(10)

Stimulation at acupressure points has been shown to increase serotonin production, and endorphin can also increase serum cortisol reglucocation. Endorphin is an opiate natural produced by the body that can provide a calming and uplifting response. Acupressure, other than as a treatment that can activate neurons in the nervous system where will stimulate the endocrine glands and can activate complex organs. Besides, acupressure can also trigger glucose-6-phosphate (one of the enzymes of carbohydrate metabolism). It would affect the hypothalamus. Acupressure works on the pancreas to increase insulin synthesis by stimulating an increase in one of the receptors on the target cell and accelerating glucose use in cells to decrease blood glucose levels. GLUT 4 can increase insulin sensitivity, causing glucose carrying capacity, and the use of glucose in cells also increases (11). Acupressure therapy is one of the treatments that can be done to restore the feet' sensitivity function. The WHO recognizes acupressure as a therapy that can activate neurons in the nervous system, stimulating the endocrine glands and activating the complex organs (10).

Active stretching is part of the control effort Diabetes. The benefits of active stretching for diabetic patients can increase cell sensitive complex insulin, which increases glucose by cells in the body and can also increase energy use to decrease dynamic sugar levels and leg sensitivity (12).

Based on the results of previous studies conducted by Jumari it was found that the effect of acupressure effectively reduced blood glucose levels in diabetic patients (13). A study conducted by Nurul Aktifah found that active stretching was not effective enough to improve the control of patients' blood sugar levels. Where active stretching is a form of exercise on one's body by moving independently without the sufficient here. In this study, the researchers wanted to examine dynamic stretching with different steps. It was designed to be more useful to improve and prioritize the independence of patients.12 This is in line with research conducted by Sigit Priyanto in which leg sensitivity is better in the elderly after being given foot exercises (14).

From the description above, further research is needed as an innovation in nursing by combining acupressure pen and active stretching. This application is expected to make it easier for patients and nurses to emphasize the meridian points found in the lower extremities. At the same time, the patient is also directed to do active stretching. So by combining the two measures, it is expected that the reduction in fasting blood sugar is more effective in patients with type 2 diabetes.

OBJECTIVE

This study examines the effectiveness of acupressure pen and active stretching *(Acupenas)* on fasting blood sugar levels in type 2 diabetes mellitus patients.

METHODS

This study uses true experimental research with pre-test and post-test control group design. Researchers arranged two groups, such as the intervention group who received the acupressure pen and active stretching therapy (*Acupenas*) with the metformin drug 2x500 mg. In contrast, the control group only received therapy metformin drug 2x500 mg without acupressure pen and active stretching (*Acupenas*). Acupressure pen and dynamic stretching (*Acupenas*) therapy performed three times per week for 30 minutes for three weeks.

Examination of blood sugar levels using a handscoon, alcohol swab, and glucometer consisting of lancet needles, strips, and measuring device. Assessment of blood sugar levels

of respondents who have Diabetes Mellitus is done in the morning after fasting for 8 hours with the time before (pre-test) and after the therapeutic action (post-test).

This study's population was patients registered for treatment at the Argamakmur regional public hospital North Bengkulu in January-December 2019. Determination of the minimum sample size using techniques probability sampling with method simple random sampling and based on inclusion and exclusion criteria as many as 38 respondents were divided into two groups with each of the 19 respondents in the intervention group (Acupressure pen and active stretching therapy (*Acupenas*) with metformin drug 2x500 mg) and 19 respondents in the control group (therapy metformin drug 2x500 mg).

In this study, researchers conducted data collection through observation, identification, interviews, and filling in the observation sheets. The data collected were analyzed through the IBM SPSS program version 24.0 and continued with different tests, namely parametric tests (Paired t-test and independent t-test). The processed data is used to discuss statement matters, which are then presented in tabular form.

RESULTS

Table 1 Frequency distribution of respondents from gender, education, profession, Diabetes Mellitus duration, sports, and age-based on demographic data

Characteristics	Intervention (n=19)		Control (n=19)		P
	N	%	N	%	
Gender					0.532
Male	8	42.1	7	36.8	
Female	11	57.9	12	63.2	
Education					0.143
Elementary school	4	21.1	2	10.5	
Middle School	3	15.8	5	26.3	
High school	6	31.6	10	52.6	
College	4	21.1	1	5.3	
No school	2	10.5	1	5.3	
Occupation					0.112
Entrepreneur	2	10.5	5	26.3	
Farmers	1	5.3	0	0	
Civil servants	1	5.3	6	31.6	
Housewife	11	57.9	7	36.8	
Retired	4	21.1	1	5.3	
DM duration					0.079
DM <10 years	15	78.9	17	89.5	
DM >10 years	4	21.1	2	10.5	
Sports					0.460
Yes	14	73.7	15	78.9	
No	5	26.3	4	21.1	
Age (Mean ± SD)	59.95±7.184		53.16±7.120		0.929
Total	19	100	19	100	

**Homogeneity Test*

Table 1 explained the characteristic of respondents. The findings showed that all variables of gender, education, occupation, duration of Diabetes Mellitus, sports, and age

between the intervention group and control group were not significantly difference with a p-value >0.05.

Table 2 mean difference of blood sugar levels before and after treatment among the intervention group and the control group

Group	Pre-test Mean ± SD	Post-test Mean ± SD	Delta	P-value
Interventions	154±14.735	112.53±9.282	-41.47±16.625	0.000*
Control	153.95±13.930	128.74±4.629	-25.21±13.394	0.000*

**Paired t-test*

Table 2 showed the differences in blood sugar levels before and after treatment in the intervention and control groups. However, the difference in the decrease in blood sugar levels in the intervention group -41.47 was more significant than the control group -25.21.

Table 3 mean difference blood sugar levels between the intervention group and the control group

Variable	Intervention group	Control Group	Mean Difference	P-value
	Mean ± SD	Mean ± SD		
Blood Sugar Levels	112.53±9.282	128.74±4.629	-16.21	0.000
Delta Blood Sugar Levels	-41.47±16.625	-25.21±13.394	-16.26	0.002

**Independent t-test*

Table 3 showed that there are differences in a significant decrease in blood sugar levels between the intervention group and the control group with a p-value of 0.000 (<0.05) and the mean difference of p-value 0.002 (<0.05). The conclusion is that the intervention group is better at reducing blood sugar levels than the control group.

DISCUSSION

The results showed a change in fasting blood sugar levels seen from the mean value analysis before treatment that is 154.00 mg/dl. After three weeks of intervention, the mean value changed to 112.53 mg/dl (p=0.000). The results paired t-test obtained mean difference decrease at week 1 to week 3 amounted to 41.47 mg/dl. So it can be concluded that the hypothesis (Ha) is accepted, which means that the administration of *Acupenas* is proven effective in reducing fasting blood sugar levels to within normal limits.

Acupressure is a term commonly used to provide stimulation at *acupoints* using fingers or tools with emphasis. Acupressure at points ST.36, ST.40, LV.3, and SP.6. can activate neurons in the nervous system where will stimulate the endocrine glands and activate complex organs. Also, acupressure can activate glucose-6-phosphate (a carbohydrate metabolism enzyme), which affects the hypothalamus. Acupressure works on the pancreas to increase insulin synthesis by stimulating an increase in one of the receptors on the target cell and accelerating glucose use in the section to reduce blood glucose levels. GLUT 4 can increase insulin sensitivity, causing glucose carrying capacity, and the use of glucose in cells also increases [15].

Besides acupressure, other therapies that can also be done to reduce fasting blood sugar levels to control Diabetes a reactive stretching. The benefits of active stretching for

diabetic patients can increase the sensitivity of cells to insulin, increase glucose by cells in the body, and increase energy use so that blood sugar levels can occur[12].

Movement in muscles can increase glucose requirements utilizing glucose in the blood used as energy. Active muscles will affect the circulation of insulin by increasing nitricoxide and blood vessels become dilated, thereby helping the entry of sugar into cells, because the active muscle insulin receptor sensitivity will increase so that sugar uptake increases (16).

This is in line with acupressure research to reduce fasting blood sugar levels conducted by Zarvasi (2018). It found that acupressure administration at 4 (four) points with a duration of 5 minutes suppression can reduce fasting blood sugar levels of patients with type II diabetes mellitus with a p-value was 0.001 (17). A similar sentiment was also stated by Dwi Hardika (2018) that research on foot exercises to reduce blood sugar levels carried out showed that foot exercises could lower blood sugar levels of patients with type II diabetes mellitus with a significance value = 0.001 (18).

Results of statistical tests in a study conducted by Zarvasi (2018) and researchers alike, there were significant differences (p=<0.05). If seen from the calculation results, Cohen's effect size in previous studies conducted had Cohen's effect size lower moderate category (0.58) compared to Acupenas research to reduce fasting blood sugar levels extreme type (2.2).

Efforts in controlling blood sugar are not significant only done with medication alone, because patients who have diabetes mellitus are caused by damage to the pancreas in producing insulin, where insulin is functioning in controlling blood sugar levels. Decreased blood sugar levels as an indication of the improvement in diabetes mellitus experienced. Therefore, acupressure and physical activity provision is an effective way of managing diabetes mellitus (14).

Each patient has a different ability to perform self-care. Differences in self-care ability in these patients cause differences in fasting blood sugar level scores in patients with type 2 diabetes mellitus. Self-care is essential to be done by patients with type 2 diabetes mellitus who aims to prevent complications (19-20). Self-care performed by patients with Diabetes mellitus is closely related to the theory put forward by Orem in nursing theory. Orem's theory in the order of nursing services is aimed at the needs of individuals in carrying out independent nursing actions and regulating all their needs. In nursing practice, OREM develops three forms of theory, namely theory self-care, describing why and how humans do. The theory of self-care deficit describes why humans need nursing assistance. The last concept related to nursing systems' idea illustrates how nursing care can give to humans (21-22).

CONCLUSION

Based on data processing and analysis, the effectiveness of acupressure pen, and active stretching (Acupenas) as an alternative to complementary therapy. It concluded that the average decrease in blood sugar levels in the intervention group -41.47 mg/dl was more much compared to the average reduction in blood sugar levels in the control group by a difference of -25.21 mg/dl with a p-value of 0.002 (<0.05). In conclusion, complementary therapy with an acupressure pen and active stretching (Acupenas) is effective in reducing blood sugar levels, so that the intervention group is better than the control group.

Education from complementary therapy material in nursing care is considered appropriate to increase patient independence towards health needs. Control of blood sugar levels can be done with various efforts, including self-care management and complementary therapies such as acupressure and active stretching. Acupressure techniques are easy and fast to learn, can be done anywhere and anytime, and the costs are cheaper to reduce medical costs.

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