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A combination of diabetic foot exercise and foot massage on ankle brachial index on patients with type 2 diabetes mellitus

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ABSTRACT

Diabetes Mellitus (DM) is a chronic metabolic disorder that genetically and clinically includes the heterogenic manifestation of insulin lost and high risk of hyperglycemia, atherosclerosis, and vascular disease. 4 pillars of type II diabetes management include education, diet, physical exercise and pharmacologic intervention. One of the non-pharmacology treatments is diabetic foot exercises and foot massage on Ankle Brachial Index on patients with type 2 diabetes mellitus. This study aims to assess the effect of effective diabetic foot exercise and foot massage on the Ankle Brachial Index on patients with type 2 diabetes mellitus in Srondol public health, Semarang. This study is quasi-experimental studies using pretest-posttest control group design. Moreover, this study also organizes two groups involving the intervention group with diabetic foot exercise and foot massage combination as well as a control group with a foot massage. Purposive sampling technique is used to obtain 28 respondents who are divided into two groups. Wilcoxon sign rank test result shows p-value = <0.05, meaning that there is an effect of diabetic foot exercise and foot massage on the Ankle Brachial Index between intervention and control groups on patients with type 2 diabetes mellitus.

Keywords: Type II DM, Diabetic Foot Exercise, Foot Massage, Ankle Brachial Index

INTRODUCTION

International Diabetes Federation (IDF) mentions the prevalence of DM in 2017 is estimated that 425 million people at ages 20 – 79 years old suffer from Diabetes Mellitus, making Indonesia diabetes population becomes the sixth-largest in the world which accounted for 10.3 million people and is predicted to increase for 21.3 million people in 2030. The rising number of diabetes cases will lead Indonesia to the fourth position after China, India and the USA.

Based on Basic Health Research in 2018, Indonesian's diabetic cases rapidly increase from 6.9% in 2013 to 10.9%. In Central Java Province, DM prevalence in 2016 is the second-largest case following hypertension cases at 16.42%. Besides, in 2017 DM cases in Semarang is the highest non-communicable disease (NCD) that made up 17.037 cases. Based on the previous research in 2017, the total of DM prevalence in Srondol public health care is 661 patients with diabetes mellitus with average visit of 55 patients in a month. Meanwhile, in 2018, the total patients with DM increase rapidly of 1143 patients of non-insulin dependent and 7 patients of insulin-dependent. Type II DM is the second largest disease case following hypertension cases out of the 5 largest non-communicable diseases in Srondol Public health care[7],[8],[9].

DM patients who are not controlled well potentially suffer from some complications, including acute or chronic complications. Acute complications consist of hypoglycemia coma, ketoacidosis, nonketotic hypoglycemia coma, whereas chronic complications are macroangiopathy that damages the large blood vessels in the heart and the brain.

B cell dysfunction and insulin retention can cause DMT2. Besides, DMT2 is not only caused by the reduction of insulin secretion from the pancreas but also the failure of the cells in responding to insulin normally. Insulin retention is caused by obesity or over-weight, the lack of physical activity, and

aging. In patients with type 2 diabetes mellitus, the hepatic glucose production occurs but no damage to pancreatic B cells [12].

Improperly controlled DM can cause some chronic diseases involving cerebrovascular, coronary heart disease, varicose vein, eye disorders, kidney diseas and nerve disorder. The attempt to be fully recovered is difficult because the injury is commonly permanent. Early prevention is needed to overcome complications and is expected to avoid some unfavorable situation [13].

Blood flow disorder in the legs can be detected by calculating the Ankle Brachial Index (ABI) which calculates the ratio from systolic pressure in the arm with systolic pressure in the lower leg14. ABI is calculated by dividing systolic pressure between the ankle and systolic pressure in the arm. ABI test is useful to assess the Peripheral Artery Disease (PAP)[15],[16].

The previous research about Ankle Brachial Index applying diabetic foot exercise treatment on type 2 diabetes mellitus patients proved that after having diabetic foot exercise, there is an improvement in ABI's value [18]. Otherwise, the other researchers found out that diabetic foot exercise can effectively improve the Ankle Brachial Index of type 2 diabetes mellitus patients [19].

Some strategies are done to prevent and control neuropathy diabetic and peripheral artery disease including 5 pillars of DM management such as education, nutrition, physical exercise, self-glucose monitoring, and pharmacology therapy. One of the complementary therapies is foot massage. Besides blood glucose maintenance, patients with diabetes mellitus can get a massage routinely on their foot every day [20].

The research conducted by Sunarti in Semarang entitled "The effects of diabetes mellitus foot exercise and foot massage combination on ankle-brachial index (ABI) value toward patients with type 2 diabetes mellitus proven that there is an effect of the combination between diabetic foot exercise and foot massage on Ankle Brachial Index (ABI) on patients with type 2 diabetes mellitus [21]

Providing the intervention of diabetic foot exercise and foot massage combination is the activity that can be done by patients with type 2 diabetes mellitus to prevent complications from diabetes mellitus and to smooth the blood circulation in the leg.

Based on the explanation above the diabetic foot exercise and foot massage can increase ABI's value. Most of the researches only used one variable which is diabetic foot exercise and foot massages shown in the ABI value.

Accordingly, there should be research about the benefit of Diabetic Foot Exercise and Foot Massage on ABI toward Patients with Type II Diabetes Mellitus at UPT Puskesmas Srondol, Semarang.

MATERIALS AND METHODS

The research design used in this research is quasi-experimental with two groups pre-test-post-test control group. This research type is used to analyze the effectiveness of diabetic foot exercise and foot massage combination of ABI for patients with type II diabetes mellitus.

Population reference in this study is patients with Type II Diabetes Mellitus in UPT Puskesmas Srondol, Semarang in May 2019.

The intervention of diabetic foot exercise and foot massage combination is done in 3 weeks for 45 durations for 4 times a week. The improvement of ABI is calculated every week using Doppler vascular.

After the calculation, the data are processed using the 22 version of SPSS software. The data are analyzed by using a statistical test of Wilcoxon Signed Rank Test.

RESULTS AND DISCUSSION

There are several causative factors of type II Diabetes Mellitus (DM). According to Norris et al. (2002), daily lifestyle potentially becomes the causative factor of DM [59],[60]. An unhealthy lifestyle can be the prominent cause of DM increase number in urban areas whereas DM has great impacts for both the sufferer and society61. Besides, this research finds that type II DM is also likely caused by age and sex.

Regarding this research, the average age of the participant suffering from type II DM is 58 years old. In this age, people are susceptible to many diseases such as heart disease, vascular system, hypertension, obesity, etc. Further, they are highly at risk to suffer from arteriosclerosis causing calcification in the blood lumen[62]. Normality test results of data measurement by using Shapiro-wilkfor intervention group and control group.The results and the discussion of independent T-test are as follows:

1. Distribution frequency of age, sex and the length of DM suffering

Table 1: Distribution frequency of age, sex and the length of DM suffering

Variable	categories	Intervention			control			*P*
		N	(%)	Mean ± SD	N	(%)	Mean ± SD	
Age	-	14	50	57.86± 4.365	14	0	57.93±4.859	0.343
Sex	Male	3	21.4	-	2	14.3	-	0.592
	Female	11	78.6		12	85.7		
The length of type II DM	5-10 years	12	85.7	1.21± 0.426	9	64.2	1.36± 0.497	0.116
	≥ 10 years	2	14.3		5	35.8		

Accordingly, the average age of the participants suffering from type II DM is 58 years old. In addition, women are highly at risk to suffer from type II DM which is 11 people (78%) in the intervention group and 12 people (85.7%) in the control group. In the length of type II DM suffering, the participants averagely suffer DM for 5-10 years which is 12 people (85.7%) in the intervention group and 9 people (64.2%) in the control group. Based on the frequency distribution of homogeneity test result shows the age variable P=0.343 > 0.05, sex P=0.592 >0.05, the length of type II DM suffering P=0.343 > 0.116 which is homogeneous and comes from the same population, P-value > 0.05. (Table 1)

2. The analysis of ABI value differences before and after a combination of foot diabetic exercise and foot massage treatment

Table 2. The analysis of differences before and after a combination of foot diabetic exercise and foot massage treatment

ABI Measurement	Intervention		Control		P
	Mean±SD	P	Mean±SD	P	
Pretest	0.667±0.154	0.035	0.552±0.074	0.001	0.001
Posttest I	0.674±0.137		0.578±0.079		
Pretest	0.667±0.154	0.003	0.552±0.074	0.001	0.001
Posttest II	0.818±0.105		0.772±0.051		
Pretest	0.667±0.154	0.001	0.552±0.074	0.001	0.001
Posttest III	0.957±0.128		0.890±0.043		

Pretest and posttest I measurement in the seventh day shows significant differences between the intervention group and the control group that is p=0.001 < 0.05. Pretest and posttest II has done on the fourteenth day show the same significant differences that are p=0.001 < 0.05 between intervention group and control group. Further, Pretest and posttest III has done in the twentieth day also show the same significant differences that are p=0.001 < 0.05 between intervention group and control group.

Based on the analysis, the intervention group and the control group can increase the ABI value of type II diabetes mellitus sufferers. Yet, the average differences of control group foot massage results can increase ABI value better than the intervention group with a combination of diabetic foot exercise and foot massage. (Table 2)

Table 3: The analysis of the difference of ABI average before and after a combination of foot diabetic exercise and foot massage treatment

ABI Measurement	InterventionControl		P
	Mean±SD	Mean±SD	
Pretest	0.667±0.154	0.552±0.074	0.001
Posttest I	0.674±0.137	0.578±0.079	
Pretest	0.667±0.154	0.552±0.074	0.001
Posttest II	0.818±0.105	0.772±0.051	
Pretest	0.667±0.154	0.552±0.074	0.001
Posttest III	0.957±0.128	0.890±0.043	

ABI average of intervention group before diabetic foot exercise and foot massage treatment is 0.667 mmHg and after the treatment, an increase of 0.957 mmHg has reached normal ABI > 0.90 (p=0.001). Meanwhile, ABI average before diabetic foot exercise and foot massage treatment is 0.552 mmHg and after the treatment, it increases for about 0.890 that is categorized as light occlusion(p=0.001). (Table 3)

Based on the statistical test, pretest and posttest I measurement in the seventh day show significant differences between the intervention group and a control group that is p=0.001 < 0.05 with a difference increase of ABI value about 0.007 in the intervention group and 0.026 in the control group. Pretest and posttest II has done on the fourteenth day show the same significant differences that are p=0.001 < 0.05 between intervention group and control group with difference increase of ABI value about 0.151 in the intervention group and 0.020 in the control group. Further, Pretest and posttest III has done in the twentieth day also show the same significant differences that are p=0.001 < 0.05 between intervention group and control group with difference increase of ABI value about 0.290 in the intervention group and 0.338 in the control group. Accordingly, both the intervention group and the control group can increase the ABI value. However, the control group with foot massage treatment can increase the ABI value better than the intervention group with a combination of diabetic foot exercise and foot massage.

In this research, diabetic foot exercise is routinely held for 21 days (3 weeks) along with all the participants of the research. Diabetic foot exercise treatment is held at 08.00 a.m. and continued with a foot massage.

As a matter of fact, the benefit of doing both diabetic foot exercise and foot massage routinely for the patient can decrease pain, restrain nerve damage, control blood sugar level and increase blood circulation of the foot.

Based on this research, Diabetic Mellitus patients are at risk to suffer from complications such as leg complications causing impaired blood flow in the legs. Impaired blood flow in the legs can be detected by the Ankle Brachial Index (ABI)

by measuring the systolic value. If ABI value is 0.41-0.91 mmHg, a light-moderate occlusion, so there is a high risk of injury to the feet. Otherwise, if ABI value is <0.40 mmHg, it indicates that the feet have experienced necrotic feet, gangrene, and ulcer. Therefore, complementary therapy or non-pharmacology is not adequate to cure. Proper treatment is needed.

CONCLUSIONS AND RECOMMENDATIONS

45 minutes of diabetic foot exercise and foot massage treatment for 4 times every week and done routinely in 3 weeks on type II DM patient affects their ABI value, such as;

1. The average of the Ankle Brachial Index (ABI) of the intervention group before the treatment is 0.667 mmHg and after the treatment, there is an increase of 0.957 that has reached normal ABI > 0.90 (P=0.001). Meanwhile, the ABI average of the control group before the treatment is 0.552 mmHg and after the treatment, there is an increase of 0.890 categorized as light occlusion (p=0.001). Statistical test results by Wilcoxon signed-rank test show a significant difference of p=0.001 meaning that a combination of diabetic foot exercise and foot massage treatment can increase the ABI value. However, foot massage in the control group is more effective to increase the ABI value.
2. The results of the research show that a combination of diabetic foot exercise and foot massage can increase the ABI value on type II Diabetes Mellitus.

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1. Nursing Profession

A nurse is expected to encourage type II Diabetes Mellitus patients to do the combination of Diabetic Foot Exercise and Foot Massage as the management of non-pharmacology including physical exercise and complementary therapy can be applied in managing nursing toward patients with ABI. Otherwise, doing one of the therapies is suggested to optimize ABI value for patients with type II DM.

2. Further Research

1. Supervising and providing Diabetic Foot Exercise and Foot Massage should be further enhanced especially the total treatment needed and the time it will take place.
2. The same research is allowed with a higher number of respondents and longer research time by applying true experimental research design using randomized controlled trials to avoid bias in the research result.

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