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Penulis : Erika Martining Wardani , Lono Wijayanti , Nur Ainayah

No. Pemeriksaan : 2022.09.26.849

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Submission ID: 1911991697

File name: ACHIAL_INDEXAND_FOOT_SENSITIVITY_OF_DIABETES_MELLITUS_TYPE_2.pdf (159.56K)

Word count: 2870

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8
**THE EFFECT OF DIABETIC FOOT SPA ON ANKLE BRACHIAL INDEX
AND FOOT SENSITIVITY OF DIABETES MELLITUS TYPE 2**

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Erika Martining Wardani^{*}, Lono Wijayanti & Nur Ainiyah

Faculty of Nursing, Universitas Nahdlatul Ulama, Surabaya, Indonesia

Abstract

Diabetes Mellitus (DM) is a metabolic disorder which marked by the hyperglycemia that appeared because of insulin secretion disorder and/or the increase of cellular insulin resistance. DM patients have a higher risk to experience foot problems due to blood vessels disorders causing the circulation of blood from legs is decreased. Purposed this research is diabetes could be prevented by doing a foot a diabetic which the activities include foot exercises, warm water cleansing and massage. The method used in this study is Quays Experiment pre-post control group design. The population on this study was patients with Diabetes Mellitus Type 2 in Waru health center. The sample used was 60 people, divided into 2 groups; intervention and control group, with sampling technique of simple random sampling. The data collection was using observation sheets of diabetic foot SPA; the tool used to assess blood glucose levels was glucometer, whereas cot, brush and needle were used to assess the foot sensitivity. The data was then analyzed with t-test. The result of the study showed that there were effecton the foot sensitivity (t=10,73, p value =0, 000) and there were effectdecrease on ankle brachial index(t=12,34, p value =0, 000). It is important for families and communities to give motivation to the diabetes mellitus patients to do diabetic foot SPA as one of alternative therapies to prevent foot complications such as foot ulcers and even amputation.

Keywords: Diabetic Foot SPA; ABI; Foot Sensitivity.

11
Article info: Sending on July 31, 2019; Revision August 14, 2019; Accepted on August 30, 2019

**) Corresponding author:
Email : erika@unusa.ac.id*

1. Introduction

Diabetes Mellitus (DM) is a metabolic disorder which marked by the hyperglycemia that appeared because of insulin secretion disorder and/or the increase of *cellular insulin resistance*. A chronic hyperglycemia and other diabetic mellitus metabolic disorder would cause the damage to tissues and organs such as eyes, kidneys, nerves and the vascular system of diabetic ulcer is a DM complications in the integumentary system, begins with numbness and tingling sensation.

Urbanization has driven the dramatic changes in the lifestyle especially in developing the country. With a fast transition along with the increase of the risk factors of noncommunicable diseases such as DM. Patients with DM type 2 could suffer from complications, both acute and chronic. Chronic complications that occur are peripheral vascular disease, and sensory and motor neuropathy. Nearly 60 % of patients suffer these complications (Black & Hawks, 2014). The current fact shows that part of people suffer from DM at Waru Health Center Sidoarjo complained about the tingling and pain sensations in their feet. Microangiopathy and macroangiopathy complications would cause a blockage of blood flow to the entire organs (Smeltzer & Bare, 2009). DM patients with ongoing gangrenous wounds could risk to amputations. DM patients have a higher chance to experience lower limb amputations 15 times than those without DM (Greenstein & Wood, 2006).

DM prevalence in the group age of 40-59 worldwide reached 387 million of people in 2014. The number is expected to increase to become 529 million people in 2035 (*International Diabetes Federation*) [IDF], 2013). According to IDF (2013) there were 9.1 million cases of DM in Indonesia. The high number of DM in Indonesia has put Indonesia in the fifth largest DM cases in the world after China, India, Brazil, and the United States (IDF, 2013). The greatest number of outpatients based on the 2012 Hospital Annual Report (as of 31 May 2013) at the hospital type B and C in East Java was DM (137.427 cases). The most number of inpatients at the hospital type B and C was DM (17.990 cases) (Risikesdas, 2012). DM disease in Surabaya, as we have already known, there was development from 2009 of 15.961, increased to the amount of 21.729 in 2010, and then increased more to the amount of 26.613 in 2011. The patients of DM continued to increase from 2009-2011. However, in 2012 the number was decreased to become 21.268 cases (Risikesdas, 2013).

A high blood glucose level and last for a long time could lead to complications and other metabolic disorders. The uncontrolled DM could cause an acute complication and chronic complication. A chronic complication that mostly happens is peripheral vascular disease, and sensory and motor neuropathy (Black & Hawks, 2014). Patients with DM have a higher risk of foot problem because blood vessels

disorders could decrease the blood circulation from the leg to the foot. It is the main cause of the increase of gangrenous cases and amputations in DM patients (Atun, 2010).

Several interventions have been done to prevent, treat and control the occurrence of complications in DM management. Foot care in DM patients could prevent from the risk of diabetic foot (Mahfud, 2012). Diabetic foot SPA is a foot care series which the activities include foot exercises, warm water cleansing and massage (Purwanti, 2013). Regular foot care could reduce the number of amputations around 50% (Suyono, 2013). It is accordance with the objectives of national program in Indonesia to control DM, which is controlling risk factors as to reduce morbidity, disability, and death caused by DM with gymnastics (Ministry of Youth and Sports of the Republic of Indonesia (KEMENPORA RI, 2010). DM foot care is one of the steps to prevent wounds on the DM patient's foot by doing foot examination, washing the foot properly, drying the foot, using moisturizers, wearing footwear, and applying first aid to the injured (World Diabetes Foundation [WDF], 2013; Huang & Chin, 2013). Warm water therapy is useful to improve blood circulation, reduce muscle tone stiffness, activate a relaxed feeling, stimulate nerve endings to create a refreshing feeling, analgesic and sedative effect (Priyanto, 2012).

Based on these phenomenon, the authors are interested in conducting research on the effect of diabetic foot SPA on blood glucose levels and foot sensitivity in type 2 diabetes mellitus patients at Waru Health Center Sidoarjo.

2. The Objective of the Study

The objectives of the study are to analyze the effect of diabetic foot SPA towards ankle brachial index and to analyze the effect of diabetic foot SPA towards the foot's sensitivity in patients with DM type 2 at Waru Health Center Sidoarjo.

3. Research Methods

The research methods uses the *Quays Experiment pre-post control group design*. Populations of this study are 170 patients with diabetes mellitus type 2 in the age range of 41-50 years old at Waru Health Center Sidoarjo. The amount of samples used were 30 interventions and 30 controls that met the inclusion criteria, which was DM patients type 2 who did not have lower extremity disorders such as diabetic ulcers, unable to walk due to fractures on the legs, aged 41-60 years, blood glucose levels was less than 600 mg % when sample determination selection was conducted, suffering from diabetes mellitus less than 5 years, and not having a chronic disease and willing to become a respondent of the research. This research uses *simple random sampling*. The independent variable of this research is diabetic foot SPA meanwhile the

dependent variables of this research are blood glucose levels and foot sensitivity. The instruments used to assess diabetic foot SPA were observation sheets, to assess *ankle brachial index* was a *tensimeter*, meanwhile the instruments to measure foot sensitivity were a needle, brush found on the base of the *hamer reflex* and cotton. The research was conducted at Waru Health Center Sidoarjo. This research has obtained ethical laik from team laik ethic Unusa.

4. Research Result And Discussion

Ankle Brachial Index

Based on Table 1, there were no significant differences on the average *ankle brachial index* before diabetic foot SPA was given to the intervention group with *ankle brachial index* before diabetic foot SPA was given to the control group ($t = 14,56, p \text{ value} = 1,581$) shows the data of *ankle brachial index* of the homogen intervention and control group. There are significance differences on the average *ankle*

brachial index after diabetic foot SPA was given to the intervention group with *ankle brachial index* after diabetic foot SPA was given to the control group ($t = 12,34, p \text{ value} = 0,000$).

Based on the results of the research conducted, differences in mean differences in the mean *ankle brachial index* before and after intervention in the intervention group were higher than the mean difference in the mean *ankle brachial index* before and after intervention in the control group. This illustrates that respondents given intervention or treatment of diabetic foot SPA have a high *ankle brachial index*. This high *ankle brachial index* value illustrates an improvement in the *ankle brachial index* after a diabetic foot SPA is performed. An increase in the *ankle brachial index* indicates a decrease in the level of disturbance of blood circulation in the foot, because the severity of diabetes mellitus will be indicated by the presence of an *ankle brachial index* which is lower or exceeds the normal threshold value.

Tabel 1 Differences of *ankle brachial index* before and after being given a diabetic foot SPA intervention

Groups	n*	Before intervention		T	p value	After intervention		t	p value
		Mean	SD			Mean	SD		
Intervention	30	302,67	115,581	14,56	1,581	259,23	95,045	12,34	0,000
Control	30	275,67	99,921			283,03	99,233		

Note : *) the sample before and after intervension are the same

In addition to foot gymnastics and warm water immersion, foot massage activities in diabetic foot SPA can also affect the *ankle brachial index (ABI)* score. As the results of research by Yuwonoet. a 2016 concluded that because the nerve point in patients with type 2 diabetes mellitus is the point of the pancreas, where the point of the pancreas is closely related to the hormone insulin which affects blood sugar (glucose) levels in the body. When emphasis is placed on reflection points on the feet, especially the pancreatic point which is located on the sole of the left right foot inside the nerve receptor edge will work and stimulation will turn into electricity or bioelectric which will spread to the brain then to the pancreas, so that the production of insulin hormone becomes better and blood sugar levels in the body to be balanced.

The results of the research, it is shown that the *ankle brachial index* in people with diabetes mellitus tends to be controlled or improved by carrying out activities primarily centered on the use of limbs.

Activities carried out must be carried out regularly, measured and carried out properly and correctly. SPA Activities Foot diabetes that is taken seriously, will be able to stimulate blood vessels more smoothly and be able to be shown until the discharge will be able to suppress the pancreas in producing insulin in increasing the *ankle brachial index*.

Foot Sensitivity

Table 2, shows that there were no significant differences on the average foot sensitivity before diabetic foot SPA was given to the intervention group with blood glucose levels before diabetic foot SPA was given to the control group $t = 2,82, p \text{ value} = 0,059$) shows the data of blood glucose levels of the homogen intervention and control group. There are significance differences on the average blood glucose levels after diabetic foot SPA was given to the intervention group with blood glucose levels after diabetic foot SPA was given to the control group ($t = 10,73, p \text{ value} = 0,000$).

Tabel 2. Differences of the foot sensitivity before and after being given a diabetic foot SPA intervention

Groups	n	Before intervention		t	p value	After intervention		t	p value
		Mean	SD			Mean	SD		
Intervention	30	2,70	0,568	2,82	0,059	2,77	0,583	10,73	0,000
Control	30	2,77	0,651			2,73	0,568		

Note : *) the sample before and after intervension are the same

Based on the result of the conducted research, shows the differences mean average of the foot sensitivity before and after intervention in the intervention group is higher than the differences average of the foot sensitivity before and after intervention in the control group. It shows that the respondents who were given an intervention of diabetic foot SPA had a higher sensitivity than those who were not.

The result of this research is accordance with the previous research of Calle, Pascual, Duran, (2001), insists that neuropathic diabetes are given a diabetic foot care by keeping the foot blood circulation resulted that the groups which are not doing a regular diabetic foot care have 13 times a higher risk of developing diabetic ulcer compared to groups which are doing a regular foot care. The essence of similarities carried out with this research shows the risk of lower extremity or foot disorders if the patients with diabetes mellitus were given the diabetic foot SPA. Whereas the difference of the research is the positive effect of Celle's research are blood circulation, while in this research of the foot sensitivity, as well as Celle's research which is only foot care in general, this research is done with diabetic foot SPA which contains foot exercises.

5. Conclusion

There were differences in blood glucose levels before and after being given diabetic foot SPA intervention in the intervention and control groups. There were differences in the foot sensitivity before and after the diabetic foot SPA intervention in the intervention and control groups. The effects of Diabetic Foot SPA can improve ABI and sensitivity of the foot. This therapy can be recommended for non-pharmacological treatment in ABI and leg sensitivity in patients with type 2 DM so that it can reduce the risk of neuropathy and can prevent complications resulting from diabetic ulcers or amputations.

6. Acknowledgement

Researchers say thank you to the Directorate of Research and Community Service, Ministry of Research, Technology, and Higher Education for the Support Provided to Researchers in the Form of Research Funds Supporting Supporting This Research Well.

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