

Improving Foot Peripheral Blood Circulation with Indicators of Ankle Brachial Index (ABI) through Diabetic Foot Spa in Diabetes Mellitus Patients of Type 2

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ABSTRACT

This work aims to analyse the impact of foot peripheral blood circulation with indicators of Ankle Brachial Index (ABI) through diabetic foot spa in diabetes mellitus patients of type 2. The research design involved experimental research with a one-group pre-post-test layout. The samples comprised 62 respondents, and the purposive sampling technique was employed. The intervention was in the form of presenting a diabetic foot spa procedure, which was carried out by means of foot exercises, which were carried out by means of foot exercises, skin cleansing, and foot massage, which were carried out for 45 minutes every day, for 5 days. The instrument used to measure blood circulation in the feet is used by the Ankle Brachial Index (ABI) measurement tool by comparing the measurement of ankle temperature measurement (right or left) with the highest systole measurement value on the right or left. The statistical test for the paired t-test obtained a p value of 0.001. This demonstrates that diabetic foot spa that was effective in improving peripheral blood circulation in patients with type DM diabetes. Therefore, the diabetic foot spa can be used as an alternative in improving peripheral blood circulation in diabetes mellitus patients of type 2.

Keywords: Diabetes Mellitus, Diabetic Foot Spa, Peripheral Circulation, Ankle Brachial Index

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INTRODUCTION

Diabetes mellitus is an increasingly prevalent non-communicable disease every year. Data shows it has increased from 6.9% in 2013 to 8.5% in 2018. In Indonesia, the largest percentage is found in Jakarta Province (3.4%), and the smallest percentage is in the East Nusa Tenggara Province (0.9%). The most dominant type of diabetes mellitus is type 2, which is around 90-95%¹⁻⁶

The diabetes mellitus of type 2 can cause various complications, including microangiopathy and macroangiopathy. Microvascular includes retinopathy, nephropathy and neuropathy, while macrovascular damage includes coronary artery disease, damage to cerebral blood vessels and damage to the peripheral blood vessels in the legs, as a result of peripheral circulation in the legs, which is commonly referred to as diabetes feet^{4,7}.

Various interventions to prevent complications are attempted, including foot exercises, foot massages and joint range of motion exercises. One type of therapy that is recently developing is the diabetic foot spa. A diabetic foot spa is a therapy treatment for patients with diabetes mellitus as a whole, starting from foot exercises, cleansing (skin cleansing), foot mask, and foot massage⁸⁻¹⁴.

The intervention is part of a foot care routine which is among the factors that can affect peripheral blood circulation. Diabetic foot spa is a foot care activity which involves activities such as foot exercises, cleaning the feet with warm water, and a foot massage. These activities not only smoothen blood flow, but also make patients feel comfortable and relaxed^{15,16}.

Another intervention as a comparison of diabetic foot spa is the Buerger Allen Exercise, in Makiyah's (2018) study the Buerger Allen Exercise is able to increase the use of glucose by active muscles so that glucose in the blood can decrease, can help prevent peripheral artery disease, and increase blood flow to arteries and has a positive effect

on glucose metabolism¹. In addition, in Arwani's (2014) study, breathing exercise as a non-pharmacological intervention can improve circulation and oxygenation so that the perfusion of the injured tissue increases². From the two studies, there are alternative interventions that can also be used to overcome peripheral circulation problems, namely diabetic foot spa.

Among the research results on diabetic foot spa, there remains no research work that proves a diabetic foot spa to improve peripheral circulation by using the Ankle Brachial Index (ABI). The purpose of this research is to determine the effectiveness of diabetic foot spa on improving peripheral circulation in patients with diabetes mellitus of type 2.

METHOD

This study involved a one-group type pre-post-test design. The population involved patients suffering from diabetes mellitus of type 2 that were being treated in Pelni Hospital, Jakarta. This study involved 62 respondents. Interventions were in the form of providing foot gymnastics procedures called diabetic foot spa, a therapy used for people with diabetes mellitus, in order to avoid complications of peripheral arterial disease. This was done by a foot gymnastics routine, which involved foot soaking (skin cleansing), and foot massage, which is carried out for 45 minutes every day, for a total of 5 days. The study uses a purposive sampling technique. Data were collected on 1 February, and 22 December 2019. The samples involved 62 respondents, with the criteria of having type 2 diabetes mellitus, with a disease duration of between 1-5 years. The instrument used to measure peripheral blood circulation in the foot was an Ankle Brachial Index (ABI). This involved comparing the highest systole measurement value of the ankle (right or left) with the highest brachial systole measurement value (right or left). The final assessment values are ABI value $\geq 0,9$ = normal, 0.71 - 0.90 = mild obstruction, 0.41 - 0.70 = moderate obstruction, and <0.40 = severe obstruction.

This research was approved by the Ethical Review Board (ERB) Committee of the University of Muhammadiyah, Jakarta (Jakarta, Indonesia; ERB No. 012/2019). The research participation agreement form included a statement that participants can withdraw their participation at any time, the data collected only can be used for research purposes, and participant anonymity can be enforced. Participants gave their consent voluntarily after a thorough explanation. Data analysis determined the effectiveness of Diabetic Foot Spa on peripheral blood circulation in patients with

Type 2 DM using a paired t-test. The level of significance was set at $P < 0.01$.

RESULTS

Table 1 shows that the majority of respondents were aged 35-45 years, namely, 24 respondents (38.7%). Most of the respondents were female, namely, 36 respondents (58.1%). The majority of the respondents suffered the disease for a duration of 3-5 years, namely, 38 respondents (61.3%).

Table 1. The distribution of Respondents Based on age, sex, and length of suffering in Pelni Hospital, Jakarta, Indonesia (n = 62)

Variable	Frequency (n)	Percentage (%)
Age		
35-45	24	38.7
46-55	20	32.3
56-65	10	16.1
66-80	8	12.9
Gender		
Male	26	41.9
Female	36	58.1
Long Suffering		
1-2 Years	24	38.7
3-5 Years	38	61.3

Table 2 shows that among 62 respondents having pre-test peripheral blood circulation, 38 people (61.3%) obtained normal peripheral blood circulation. The respondents with peripheral blood circulation mild obstruction involved 24 people (38.7%). The post test of peripheral blood circulation obtained respondents a with normal peripheral blood circulation to be 56 people (90.3%), and respondents with peripheral blood circulation mild obstruction were only 6 people (9.7%).

The data obtained an average value of respondents before the given Foot Spa Diabetic (pre-test) to be 1.39, and after being given a Diabetic Foot Spa (post-test) to be 1.10. The statistical test results after a paired t-test obtained a p value of 0.001, which means the foot spa diabetic is effective in improving peripheral blood circulation in patients with type 2 DM.

Table 2. Effectiveness of diabetic foot spa on peripheral blood circulation in diabetes mellitus of type 2 for the patients treated at Pelni hospital, Jakarta, Indonesia (n = 62)

Variables	Pre administration of diabetic foot spa				Post administration of foot spa diabetic				p-value
	n	%	Mean	SD	n	%	mean	SD	
Normal	38	61.3	1.39	0.495	56	90.3	1.10	0.301	0.001
Mild Obstruction	24	38.7			6	9.7			

DISCUSSION

Based on results obtained, the average value of peripheral blood circulation of the feet, pre-test, is 1.39. The average post-test score was 1.10. Furthermore, the statistical test results from the paired t-test obtained a p value of 0.001. The statistical results from a paired t-test obtained a p value of 0.001, which means that the diabetic foot spa is effective in improving peripheral blood circulation of feet in type 2 DM patients at Pelni Jakarta Hospital.

A foot spa is a foot care activity that is needed by diabetic patients to prevent the emergence of gangrene wounds, and for the prevention of the emergence of diabetic feet. The principle of preventing diabetic foot is to avoid injury and continuously trying to control the state of blood sugar. In the diabetic foot spa, in addition to foot gymnastics activities, cleansing (skin cleansing) and pedicure or cutting nails are intended to prevent the nails to become too long and hurt the foot. A foot massage is also important, besides gymnastics activities legs, skin cleansing, pedicure and foot mask. In a foot massage, certain points that connect to the organs of the pancreas to stimulate insulin production are massaged. The massage area at the left side of the foot can stimulate the pancreas to produce insulin. A foot massage is also very popular because in addition to its benefits for blood circulation, it provides a laxation effect¹⁹⁻²².

The circulatory system is built by blood as a transportation medium where the material to be distributed is dissolved or deposited, and blood vessels function as channels to direct and distribute blood from the heart, throughout the body, and return it to the heart. The heart functions to pump blood to flow throughout network. The circulatory system plays the role of homeostasis, by functioning as the body's transportation system by transporting oxygen, carbon dioxide, waste substances, electrolytes, nutrients and hormones, from one part of the body to another organs²³⁻²⁵.

The results of research conducted by Affiani & Astuti show that the diabetic foot spa was effective against peripheral blood circulation²⁶. This research is also in alignment with that by Suyanto, who shows that there was a difference in the mean increase in foot sensation given a combination of diabetic foot exercises and SPA therapy, compared to only diabetic foot exercises (p value <0.05)²⁷. The combination action of diabetic foot exercises and SPA therapy was more effective in increasing the sensation of the foot, which can affect the reduced risk of injury in DM patients. The research results show that a diabetic foot spa helped to accelerate peripheral blood circulation in patients with diabetes mellitus, so that it has a good impact on the value of ABI.

CONCLUSION

A diabetic foot spa can effectively launch peripheral blood circulation in diabetes mellitus of type 2 for patients. It had an impact on the Ankle Brachial Index (ABI) value by measuring the ratio of the systolic blood pressure of the foot (Ankle) to the systolic blood pressure of the arm (Brachial), in order to determine circulation problems and diagnose lower extremity peripheral artery disease. In conclusion, the results achieved by this study show that the average value of peripheral blood circulation of the feet, pre-test, is 1.39, while the average post-test score was 1.10 (p value = 0.001). This shows that the diabetic foot spa is effective in improving peripheral

blood circulation of feet in type 2 DM patients at Pelni Jakarta Hospital.

ACKNOWLEDGEMENTS

The authors thank the Muhammadiyah University of Jakarta for facilitating this research.

CONFLICT OF INTEREST

The authors have no conflicts of interests to declare.

FUNDING

None.

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