



## Decreased Ankle Brachial Index Score against Distance Covered During Six Minute Walk Test in Diabetes Mellitus Type 2 Patients

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### ARTICLE INFO

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### ABSTRACT

Diabetes mellitus (DM) is a metabolic disease with characteristics of hyperglycemia due to abnormalities of insulin secretion, insulin action or both. DM is a risk factor for Peripheral Artery Disease (PAD). PAD is a progressive narrowing process of peripheral arteries, especially in the inferior limb arteries. As a result, there is a reduction in blood flow to the affected limb. Most patients do not show symptoms, but many also experience intermittent claudication. PAD can be diagnosed and its severity assessed using the Ankle Brachial Index (ABI) Score. PAD can cause disturbances in muscle mass and strength so that it can cause limitations in walking ability including gait, walking speed, and balance which ultimately impair Six Minute Walk Test (SMWT). The purpose of this study was to see whether there is an effect of decreasing ABI Score on distance covered during SMWT in diabetic patients. This study was analytic observational with a cross sectional study design using primary data and secondary data from DM patients who have never been diagnosed with PAD in Polyclinic of Muhammadiyah Hospital in Palembang. The sample size in this study was 40 patients with type 2 DM who were selected using nonprobability sampling with consecutive sampling method. The subject have their ABI and SMWT measured. The collected data was analyzed by chi-square test. In this study, the significance value was  $p = 0.016$  ( $p < 0.05$ ) which can be concluded that there was an effect of decreasing ABI score on distance during SMWT in DM patients-

### INTISARI

Diabetes melitus (DM) adalah suatu penyakit metabolik yang memiliki karakteristik hiperglikemia yang terjadi karena kelainan sekresi insulin, kerja insulin atau kedua-duanya. DM merupakan salah satu faktor resiko terjadinya *Peripheral Artery Disease* (PAD). PAD merupakan suatu proses penyempitan secara progresif dari arteri perifer, terutama pada arteri ekstremitas inferior. Akibatnya, terjadi pengurangan aliran darah ke anggota tubuh yang terkena. Kebanyakan pasien tidak menunjukkan gejala, tapi banyak juga yang merasakan nyeri saat berjalan (*intermittent claudication*). Dimana PAD dapat didiagnosa dan dinilai tingkat keparahan menggunakan *Ankle Brachial Index*(ABI)Score. PAD dapat menyebabkan gangguan pada massa dan kekuatan otot sehingga dapat menyebabkan keterbatasan dalam kemampuan berjalan termasuk gaya berjalan, kecepatan berjalan, dan keseimbangan yang pada akhirnya memperpendek jarak dari SMWT. Pada Penelitian ini bertujuan untuk melihat adakah pengaruh penurunan *ABI Score* terhadap jarak tempuh selama *Six Minute Walk Test*(SMWT). Penelitian ini bersifat analitik observasional dengan desain *cross sectional study* dengan menggunakan data primer dan data sekunder dari pasien DM di Poliklinik Rumah Sakit Muhammadiyah Palembang. Besar sampel pada penelitian ini sebanyak 40 orang pasien penderita DM tipe 2 yang belum pernah didiagnosis PAD, dipilih

menggunakan *nonprobability sampling* dengan metode *consecutive sampling*. Sampel nantinya akan dinilai ABI dan jarak SMWT lalu data yang terkumpul akan dianalisis dengan uji chi-square. Pada penelitian didapatkan nilai signifikansinya  $p=0,016$  ( $p<0,05$ ) yang dapat disimpulkan bahwa terdapat pengaruh penurunan ABI score terhadap jarak tempuh selama SMWT pada penderita DM.

## Introduction

Diabetes mellitus (DM) is a metabolic disease with characteristics of hyperglycemia due to abnormalities of insulin secretion, insulin action or both. These pathological conditions can encourage the formation and development of Peripheral Artery Disease (PAD). PAD is a progressive narrowing of peripheral arteries, especially inferior limb arteries.<sup>1,2,3</sup> PAD is a disease most often caused by atherosclerosis, an atherosclerotic plaques that cause arterial stenosis or occlusion. As a result, there is a reduction in blood flow to the affected limb. Most patients do not show symptoms, but many also experience intermittent claudication. If the decrease in blood flow is very severe, the extremity becomes ischemic and causes pain at rest or loss of tissue (ulceration or gangrene)<sup>4</sup>.

Ankle Brachial Index (ABI) is a non-invasive tool that can diagnose and assess the severity of not only lower extremity PAD but also a strong marker for atherosclerosis in general and cardiovascular risk. The ABI value is obtained from the measurement of blood pressure on the feet and hands and then compares the results of these measurements<sup>5</sup>. PAD in DM patients can cause disturbances in muscle mass and strength, causing limitations in walking ability including gait, walking speed, and balance which ultimately shortens the distance of SMWT<sup>6</sup>.

The Six Minute Walk Test is a simple, objective, inexpensive, time-consuming and efficient test to assess functional capacity and is very useful for assessing the prognosis of patients in their daily lives<sup>7</sup>. This study aimed to see a decrease in ABI Score against distance covered during SMWT in DM type 2 patients in Palembang.

## Methods

This study was an observational analytic study with a cross sectional study conducted at Polyclinic of Muhammadiyah Hospital in Palembang in October 2018. Independent variable is ankle brachial index and dependent variable is distance covered during SMWT. Sample of 40 people who fulfilled the inclusion criteria of ages between 40 and 70 years old, diagnosed with DM by doctors and have never been diagnosed with PAD. The exclusion criteria were unwillingness to take part in the study, neuromusculoskeletal disorders in the inferior limb (trauma, ulcer, arthritis, hemiparesis, paralysis and others), unstable angina or myocardial infarction in the past month, systolic blood pressure > 180 mmHg and diastolic > 100 mmHg, cognitive impairment, pregnant patients, CHF patients and moderate to heavy asthma.

Samples were selected with nonprobability sampling using the consecutive sampling method where all subjects who arrived in October 2018 and fulfilled the selection criteria were included in the study until the required number of subjects was fulfilled. The data was collected by means of type 2 DM patients who visited the internal medicine clinic at the Muhammadiyah Hospital in Palembang who met the inclusion criteria. Informed consent and interviews were conducted to find out additional information needed for the study. After that, patients have their ABI score SMWT measured. The correlation between decrease in ABI score and the distance covered during SMWT was analyzed using Chi-Square test.

## Result

Forty patients aged 40-70 years old fulfilled the inclusion and exclusion criterion, 25% patient who have never been diagnosed PAD had ABI score <0.9 and most patient (62,5%) have SMWT  $\leq 300$ m (Table 1).

**Table 1.**  
Baseline Characteristics

Characteristic	N	(%)
Age		
40-49 years old	7	17.5
50-59 years old	17	42.5
60-70 years old	16	40.0
Sex		
Man	16	40.0
Woman	24	60.0
Nutritional Status		
Underweight	2	5.0
Normal	19	47.5
Overweight	7	17.5
Obesity	12	30.0
Smoking Status		
No	29	72.5
Yes	11	27.5
6MWT Distance		
$\leq 300$ m	27	67.5
>300-400m	13	32.5
ABI Score		
$\geq 0.9$	10	64.9
<0.9	30	35.1

According to Table 2, no respondents with ABI score  $\leq 0.9$  who can go through SMWT of more than 300 meters. On the other hand, 13 patients with ABI >0.9 have SMWT as far as more than 300 meters. The results of the Chi-Square test, where the p value 0.016 ( $p < 0.05$ ) which means there is an effect of decreasing ABI score on the distance covered during SMWT in DM type 2 patients.

**Table2.**  
Comparison of ABI and SMWT Distance values

		ABI * SMWT Crosstabulation		Total
		SMWT ≤300 meter	>300 meter	
ABI <0.9	Count	10	0	10
	Expected Count	6.8	3.3	10.0
≥0.9	Count	17	13	30
	Expected Count	20.3	9.8	30.0
				p=0.016
Total	Count	27	13	40
	Expected Count	27.0	13.0	40.0

**Discussion**

Ten patient who have never been diagnosed with PAD have ABI score <0.9 and all of this patients have poor SMWT (<300m). Most PAD patients do not show symptoms but have affected quality of life. The poor SMWT by respondents with ABI score <0,9 was due to DM patients with PAD that can cause disturbances in muscle mass and strength so that it can cause limitations in walking ability including gait and walking speed. In a study conducted by Adiniyi et al (2009), it was found that DM patients have a lower average 6MWT which was 318.57 ± 43.72 meters compared to the average 6MWT of patients without DM, which was 596.43 ± 54.78 meters<sup>8</sup>. Some patients with ABI score ≥0.9 have poor distanced covered because there are other factors that can affect 6MWT such as height, weight, motivation and age<sup>9</sup>.

This findings were in line with Parmenter, B. et al. (2013) concerning the relationship of ABI values with a distance of 6MWT in PAD patients (r = 0.32 and p = 0.05) and by Nardi-Gomes et al (2015) (r = 0.216 and p = 0.006). Both studies stated that there is a significant relationship between the ABI and the distance covered during SMWT. This is because the formation of atherosclerotic plaques in PAD causes arterial stenosis or occlusion which is a cause of skeletal muscle injury characterized by loss of muscle fiber and mild atrophy of the affected muscle. It also has the potential to cause loss of musculoskeletal and heart muscle strength, physical inactivity, reduced functional capacity and ultimately reduced quality of life<sup>6,10</sup>.

In conclusion, there is an effect of decreasing in the ABI Score towards the distance covered during SMWT in DM type 2 patients with a significance value of p = 0.016 (p <0.05).

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