EARLY DETECTION OF PERIPHERAL ARTERIAL DISEASE (PAD) BY ANKLE BRACHIAL INDEX (ABI) EXAMINATION IN TYPE 2 DIABETES MELLITUS PATIENTS

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ABSTRACT
Diabetes mellitus is one of the most common health problems in Indonesia. This disease has various complications, including the occurrence of pheriperal arterial disesase (PAD). One method to detect PAD is to examine the ankle brachial index (ABI). This study aims to conduct early detection of PAD incidence in diabetes mellitus patients. This research is a descriptive study with a population of 5649 and a total sample of 104 respondents who were taken using accidental sampling method. Data was collected through visits to the respondent's house. ABI data were collected using 8 MHz vascular doppler. On the right leg, there were 13 respondents who experienced PAD (11 mild occlusion and 2 moderate occlusion), for the left leg there were 13 respondents who experienced PAD (8 mild occlusion and 5 moderate occlusion). PAD is one of the complications that can occur in patients with diabetes mellitus. Early detection of PAD is important, because most patients with PAD do not feel any symptoms. This is important to prevent diabetic ulcers in the patient's feet.

Keywords: ankle brachial index; diabetes mellitus; early detection; peripheral arterial disease

INTRODUCTION
Diabetes mellitus (DM) is one of the diseases with the highest number of sufferers in Indonesia after hypertension, stroke and heart failure. In 2019, Indonesia was ranked 7th as the country with the highest number of DM sufferers in the world, where there were around 10.7 million sufferers. The International Diabetes Federation (IDF) estimates that by 2030 there will be an increase in DM sufferers to 13.7 million sufferers (IDF, 2019). DM is characterized by an increase in blood glucose levels (hyperglycemia) as a result of decreased insulin production or resistance, which results in glucose unable to enter cells. Hyperglycemia that occurs continuously can cause various complications such as peripheral arterial disease (PAD), retinopathy, nephropathy, neuropathy or cardiopathy .

PAD is a condition characterized by occlusive atherosclerosis in the patient's lower extremities. PAD is one of the risk factors that cause foot ulcer and cause diabetes mellitus patients to perform amputation (Costa et al., 2017). Early detection of PAD must be done in DM patients to prevent diabetic ulcers. There are several ways to detect PAD including continuous wave Doppler (CWD), the toe-brachial index (TBI) and ankle brachial index (ABI) (Tehan et al., 2016).

One way to detect PAD is to do an Ankle Brachial Index (ABI) examination. The diagnostics criteria for PAD with diabetes mellitus defined by American Diabetes Association based on ABI are as follows : <0,40 (severe obstruction), 0,4-0,69 (moderate obstruction), 0,7-0,9 (mild obstruction), 0,9-1,3 (normal) and >1,3 (poorly compressible). Accordingly, most studies investigating the association of ABI and mortality have focused ABI ≤ 0,9 as indicator of PAD (Lilly et al., 2013).

ABI examination is a non-invasive vascular screening method to check for blood vessels and peripheral artery disease. This is a useful tool to identify PAD in clinical practice (Xu et al., 2013). The ABI value is obtained by comparing the systolic blood pressure in the ankle with the systolic blood pressure in the arm (brachialis). ABI measurements are performed using a vascular Doppler, spigmomanometer and cuff to measure blood pressure in all four limbs of the patient. ABI value can help diagnose the occurrence of vascular disease in the patient's lower extremities (Wound Ostomy and Continence Nurses Society. (2012).

ABI examination is an cheap examination and does not cause injury in patients with high sensitivity and accuracy compared to angiographic examinations (Kim et al., 2012).

About 13% of the population in the age group 50 years and over are at risk of developing PAD. PAD suffered by often does not cause significant symptoms. PAD sufferers sometimes complain of pain in the legs, especially after walking (Crawford et al., 2016). Patients with PAD are at high risk for stroke and heart disease. Early detection of PAD incidence provides an opportunity for more effective treatment, and can reduce patient morbidity and mortality (Bundo et al., 2010) This study aims to perform early detection of PAD in patients with type 2 diabetes mellitus.

METHOD
This study uses a descriptive design. The population in this study was 5649 with a sample size of 104 respondents. Sampling was done using accidental sampling method. This research was started by arranging a permit from the Makassar city investment agency and then forwarding it to the mayor of Makassar. Furthermore, the permit is forwarded to the Community health center where the research is conducted. When conducting the research, the city of Makassar was included in the covid-19 red zone, the head of the community health center refused the researcher to collect data from the community health center. The head of the Community health center suggested that researchers take data from house to house, accompanied by cadres of the community health center.

In this study, the three researchers had the same role when collecting data. Researchers took the respondent's data in the form of age, gender, length of suffering from diabetes mellitus, blood glucose levels and ABI values. The researcher conducted a direct examination to obtain the respondent's blood glucose level using a glucometer, while the ABI value was taken using an 8 MHz vascular dopler. In the data collection process, researchers still adhere to health protocols by wearing masks and handschoens and using hand sanitizers before and after touching respondents.

RESULTS
The sample size in this study was 104 respondents. Table 1 shows the characteristics of respondents based on sex. Most of the respondents in this study were female (71.2%). The minimum age of respondents (Table 2) is 29 years, while the maximum age of respondents is 87 years with an average age of 58.55 years. The results of the normality test using the Kolmogorov-Smirnov test showed that the distribution data of the right and left leg ABI values were not normally distributed, so the researchers used the median as the benchmark value. The median ABI value for the right and left feet shows the same value, namely 1.08.

Table 6 shows the interpretation of ABI values, in relation to the incidence of PAD. For the right foot, there were 76 respondents (73.1%) normal, 11 respondents (10.6%) mild occlusion and 2 respondents (1.9%) moderate occlusion. On the left leg of the respondents, there were 80 respondents (76.9%) normal, 8 respondents (7.7%) mild occlusion and 5 respondents (4.4%) moderate occlusion. The presence of occlusion (mild and moderate) indicates the occurrence of PAD in the patient's leg.

Table 1.
Characteristics of respondents based on gender (n=104)

Gender	f	%
Male	22	21,8
Female	82	71,2

Table 2.
Frequency distribution of respondents' ages (n=104)

Variable	Mean (Min-Max)	95% CI
Age	58,55 (29-87)	56,50 ; 60,60

Table 3.
Duration of having diabetes mellitus (n=104)

Variable	Median (Min-Max)	95% CI
Duration of diabetes mellitus	6 (1-24)	6,35;8,21

Table 4.
Blood glucose levels (n=104)

Variable	Median (Min-Max)	95% CI
Blood glucose levels	218 (105-458)	221,90;254,31

Table 5.
ABI values of the right and left foot (n=104)

Variable	Median (Min-Max)	95% CI
ABI in the right foot	1,08 (0,45-1,6)	1,06;1,14
ABI in the left foot	1,08 (0,4-2,0)	1,04;1,12

Table 6.
Interpretation of ABI values (n=104)

Variable	f	%
ABI in the right foot		
Mild obstruction	11	10,6
Moderate obstruction	2	1,9
Normal	76	73,1
High	15	14,4
ABI in the left foot		
Mild obstruction	8	7,7
Moderate obstruction	5	4,4
Normal	80	76,9
High	11	10,6

DISCUSSION

PAD is one of the complications that occur in diabetes mellitus patients. The risk of PAD is higher in diabetes mellitus patients who rarely control blood glucose levels. Apart from diabetes mellitus, PAD also often occurs in patients with atrial fibrillation, congestive heart failure, obstructive sleep apnea and chronic renal failure. More than 50% of PAD patients do not show symptoms, while the rest complain of leg pain which will disappear with rest (Conte & Vale, 2018). Agarwal et al (2012) found that most common symptom was intermittent claudication

which was present in all symptomatic patients PAD with diabetes mellitus and none of the patients had ulcers, gangrene, skin changes or dependent pallor.

The results of this study indicate that the majority of respondents have normal ABI values in both extremities. On the right leg, there were 13 respondents who experienced PAD (11 mild occlusion and 2 moderate occlusion), while on the left leg there were 13 respondents who experienced PAD (8 mild occlusion and 5 moderate occlusion). From observations made in the field, the majority of respondents' feet with normal and high ABI values are still in good condition, there are no wounds and can still feel touch and pain. This is different from patients with low ABI values (PAD), some of whom had diabetic ulcers and 2 respondents who experienced amputation of one of their toes. Most of the respondents with PAD did not feel any symptoms. These respondents can still carry out their daily activities smoothly. Sometimes there was pain in their legs if they walked too far, but this pain would disappear after the respondents rested. This is in accordance with the opinion of Criqui & Aboyans (2015) which states that most PAD patients do not feel any symptoms. Sometimes the patient feels pain in the legs but this will go away by itself, if the patient rests with the legs hanging down.

PAD in patients with diabetes mellitus can pose a risk of illness and death. PAD is also a sign of cardiovascular disease that can attack DM and non DM patients. Bundo et al (2010) conducted a study through follow-up of diabetes mellitus patients with PAD and without PAD for 10 years. The results of this study indicate that the mortality rate during the 10 years follow-up of diabetic patients with PAD was 52.8% compared to diabetic patients without PAD of 16.8%. Cardiovascular disease is the leading cause of death in diabetes mellitus patients with PAD. An abnormal ABI (<0.9 or >1.3) is not only a marker of (often unrecognized) PAD but also an indicator of systemic atherosclerosis. 5,6 Up to 50% of asymptomatic patients with an abnormal ABI have coronary heart disease (CHD), asymptomatic moderate/severe carotid artery stenosis, and/or abdominal aortic aneurysms (AAAs) (Paraskevas et al., 2016).

The results also showed that there were respondents with high ABI values. A high ABI value is associated with a risk of cardiovascular disease. Potier et al (2015) followed up on diabetes mellitus patients with high ABI values. A high ABI value in diabetes mellitus patients is associated with calcification of the medial arteries (Gu et al., 2019). A high ABI value is also associated with the atherosclerosis process which causes thickening of the arteries and leads to various cardiovascular diseases. The results of a study conducted by Hendriks et al (2016) also showed that patients with high ABI values were at high risk of developing myocardial infarction. Some of the respondents studied no longer controlled blood glucose levels at health centers or practicing doctors. This happened because of the Covid-19 pandemic in which the city of Makassar is a red zone. Some patients take the initiative to buy drugs directly at the pharmacy based on the last drug prescribed at the health center or doctor's practice. Some other patients turn to herbal medicines to help control blood glucose levels. There are several interventions to prevent complications of PAD, such as doing exercise or taking vasoactive drugs. According to the results of a study conducted by McDermott et al (2013) giving home exercises can increase vascularity in DM patients with PAD. Respondents in this study did a 6 minute walking exercise for 6 months. This intervention has been shown to improve the patient's ability to travel long distances on foot as well as the ability to perform daily activities.

CONCLUSION
ABI examination is one method that can be used to detect the occurrence of PAD, this examination is easy to do at an affordable cost. Diabetes mellitus patients with PAD have a higher morbidity and mortality rate than non-PAD diabetes patients. Diabetes mellitus patients

with PAD are expected to always control their blood glucose levels to prevent complications such as diabetic ulcers.

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