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Overview Of The Value Of Ankle Brachial Index Of Type 2 Diabetes Mellitus In The Kabila Health Center Area Bone Bolango Regency

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ABSTRACT

Type 2 diabetes mellitus is a chronic disease caused by impaired insulin secretion and insulin resistance, and is influenced by various risk factors such as age, diet, stress, and lack of physical activity. Complications caused by this disease include microvascular and macrovascular disorders, one of which is peripheral perfusion disorders that can be detected through an Ankle Brachial Index (ABI) examination. This study aims to determine the value of blood pressure and ABI in patients with type 2 diabetes mellitus in the working area of the Kabila Health Center, Bone Bolango Regency. The study used a descriptive quantitative method with a quasi experimental design and purposive sampling technique, involving 33 respondents. The results showed that 69.7% of respondents had high blood pressure and all respondents (100%) showed ABI values in the category of mild obstruction (0.71–0.89). These findings indicate that type 2 DM patients in the region are at risk of peripheral blood circulation disorders even though they have not shown severe clinical symptoms. Factors of age, physical activity, and the length of time you have been suffering from diabetes are factors that affect the value of ABI. It is recommended that future studies use larger samples and more accurate examination methods such as vascular doppler for more valid results.

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INTRODUCTION

There are 2 types of diabetes, namely type 1 diabetes mellitus which is the result of an autoimmune reaction to pancreatic islet cell proteins, then type 2 diabetes which is caused by a combination of genetic factors related to impaired insulin secretion, insulin resistance and environmental factors such as obesity, overeating, undereating, lack of exercise and stress, and aging (Ozougwu et al., 2014).

Type 2 diabetes mellitus (DM) is a serious chronic disease that occurs because the pancreas does not produce enough insulin (a hormone that regulates blood sugar or glucose), or when the body cannot effectively use the insulin it produces. The impact of type 2 diabetes mellitus is very complex, so it can cause complications at all cellular levels and all anatomical levels (Pebriani, 2023).

The cause of type 2 DM is not solely by a single factor but is the result of a combination of various risk factors. Risk factors for type 2 diabetes are differentiated into modifiable risk factors such as overweight (BMI), lack of physical activity, central obesity, dyslipidemia, diet (high in sugar and low fiber), stress and smoking. Meanwhile, risk factors that cannot be modified are age, gender, family history, and birth history of babies > 4000 grams (Anri, 2022).

The International Diabetes Federation in 2022 reported that 537 million adults (20-79 years old) are living with diabetes worldwide. Indonesia is ranked seventh in the world after China, India, the United States, Pakistan, Brazil, and Mexico, with around 10.7 million diabetic patients between the ages of 20 and 79 (IDF, 2022).

The incidence of DM in Gorontalo Province in 2024 will be 627 patients, and the highest number will be in Bonbolango Regency with 550 patients (Gorontalo Provincial Health Office, 2024).

Based on data from the Bonbolango Health Office, in 2024, the highest DM cases will be found in Kabila sub-district (Bonbolango Health Office, 2024). Efforts made by the Kabila Health Center of Bonebolango Regency to prevent diabetes mellitus are by managing DM including controlling blood glucose levels, regulating diet, regular exercise, drug use/pharmacological management, and lifestyle changes.

Diabetes can affect various organ systems in the body over a period of time called complications. Complications of diabetes can be classified as microvascular and macrovascular. Microvascular complications include nervous system damage (neuropathy), renal system damage (nephropathy) and eye damage (retinopathy). Meanwhile, macrovascular complications include heart disease, stroke, and peripheral vascular disease (Rosyada, 2014).

Peripheral perfusion in the form of blood circulation in the legs can be measured through non-invasive examinations, one of which is the Ankle Brachial Index (ABI) examination (Kristiani et al., 2015). ABI is the ratio of systolic blood pressure in the ankle to the arm. This examination was measured in patients with a supine position using a sphygmomanometer. Systolic pressure was measured in both arms of the brachialis artery and the posterior tibialis artery and dorsalis pedis in the legs respectively (Aboyans et al., 2012).

ABI is an examination that uses a simple method by comparing the results of systolic blood pressure measurements in the legs (ankle) and systolic blood pressure in the arms (brachial). In the ABI examination, results will be obtained that show how the state of blood circulation in the lower intestine with a normal value range of 0.9-1.2 mmHg. However, if the value obtained is less than or even more than the normal range, there is a high risk of peripheral arteries (Gitarja, 2015).

RESEARCH METHODS

The type of research used in this study is descriptive quantitative research with a Quasi-Experient research design, where the results obtained are in the form of numbers that will be analyzed statistically using predetermined calculations. According to Gay and Diehl (1992) in Bida and Maryati (2020), correlation research must use a minimum sample of 30 subjects and add 10%, which is to 33 subjects. The sampling technique used in this study uses purposive sampling techniques. Purposive sampling is a sample determination technique with certain considerations (Sugiyono, 2016). The reason for using this purposive sampling technique is because it is suitable for use for quantitative research, or studies that do not generalize (Sugiyono, 2016).

RESULT

The Kabila Health Center is one of the health services in Bone Bolango Regency. The Kabila Health Center is located on Jalan Sawah Besar, Oluhuta, Kabila District, Bone Bolango Regency. Kabila District consists of 5 villages and 7 villages, namely Pauwo Village, Tumbihe Village, Olohuta Village, North Olohuta Village, Padengo Village, Tanggilongo Village, Dutohe Village, West Dutohe Village, Poowo Village, West Poowo Village, South Toto Village and Talango Village. The working area of the Kabila Health Center in 2022 has a population of 24,374 people.

This data presents the characteristics of respondents based on age, gender, occupation, address, length of time with type 2 diabetes mellitus.

Table 1 Characteristics of respondents based on age in the Kabila Health Center area, Bone Bolango Regency.

Age			
Mean	**Median**	**Mood**	**Min-Max**
58	58	61	42-81

Source : Primary data, 2025

Based on table 1, the results of the analysis show that the characteristics of respondents based on age in the work area of the Kabila Health Center are 58 years old and the most age is 61 years, the easiest age affected by type 2 diabetes is 42 years old and the oldest is 81 years old.

Table 2 Characteristics of respondents by gender in the Kabila Health Center area, Bone Bolango Regency.

No.	Gender	Frequency	Percentage
1.	Man	5	15,2%
2.	Woman	28	84,8%
	Sum	**33**	**100%**

Source : Primary Data, 2025

Based on table 2, the results of the analysis show that the female gender is higher than that of men by 28 respondents with a percentage (84.8%), and the male gender by 5 respondents (15.2%).

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Table 3. Characteristics of respondents based on address in the Kabila Health Center area, Bone Bolango Regency.

No.	Address	Frequency	Percentage
1.	Padengo	9	27,3%
2.	Poowo	11	33,3%
3.	South Toto	13	39,4%
	Sum	**33**	**100%**

Source : Primary Data, 2025

Based on table 3, the results of the analysis show that the research sample located in Padengo village amounted to 9 people (27.3%), Poowo amounted to 11 people (33.3%), South Toto amounted to 13 people (39.4%).

Table 4 Characteristics of respondents based on work in the Kabila Health Center area, Bone Bolango Regency.

No.	Work	Frequency	Percentage
1.	IRT	23	69,7%
2.	Not Working	5	15,2%
3.	Self employed	5	15,2%
	Sum	**33**	**100%**

Source : Primary Data, 2025

Based on table 4 The results of the analysis show that the research sample as IRT amounted to 23 people (69.7%), Not Working amounted to 5 people (15.2%), Self-employed amounted to 5 people (15.2%).

Table 5 Characteristics of respondents based on the length of time they suffered from type 2 diabetes mellitus in the Kabila Health Center area, Bone Bolango Regency.

No.	Long Suffering	Frequency	Percentage
1.	4 Years	7	21,2%
2.	5 Years	15	45,5%
3.	6 Years	2	6,1%
4.	7 Years	4	12,1%
5.	8 Years	1	3,0%
6.	10 Years	4	12,1%
	Sum	**33**	**100%**

Source : Primary Data, 2025

Based on table 5, the results of the analysis show that the sample of the long-term study suffered for 4 years amounting to 7 people (21.2%), 5 years 15 people (45.5%), 6 years amounting to 2 people (6.1%), 7 years amounting to 4 people (12.1%), 8 years amounting to 1 person (3.0%), 10 years amounting to (12.1%).

After knowing the general data in this study, the following research results will be displayed related to special data which include blood pressure values and ABI values in type 2 diabetes mellitus patients in the Kabila Health Center area, Bone Bolango Regency.

Table 6 Results of the study based on Blood Pressure in respondents with type 2 diabetes mellitus in the Kabila Health Center area, Bonebolango Regency

Blood pressure		n	%
Tall	≥130	23	69,7
Usual	100 - 125	10	30,3

Source : Primary Data, 2025

Based on table 6, it can be seen that there were 23 respondents (69.7%) with high blood pressure values and low blood pressure values with 10 respondents (30.3%).

Table 7 Results of the study based on ABI values in respondents with type 2 diabetes mellitus in the Kabila Health Center area, Bonebolango Regency.

ABI Value		n	%
Usual	≥ 90	0	0
Mild Obstruction	0.71- 0.89	33	100
Moderate Obstruction	0.41 - 0.70	0	0
Heavy Obstruction	≤ 40	0	0

Source : Primary Data 2025

Based on table 7, it can be seen that the ABI value is found in the status of mild obstruction perfusion or in the value of 0.71 – 0.89 with 33 respondents (100%).

DISCUSSION
Blood Pressure in Type 2 Diabetes Mellitus Patients
The results of the study showed that the blood pressure value of type 2 diabetes mellitus patients in the working area of the Kabila Health Center, Bone Bolango Regency in table 3.6 was known to have high blood pressure values of 23 respondents (69.7%) and normal blood pressure values were 10 respondents (30.3%).

Researchers assume hypertension in people with type 2 diabetes mellitus can lead to complications such as cardiovascular, microvascular, and macrovascular. These complications can cause abnormal or peripheral blood circulation.

In the study of Hashemizadeh & Sara (2013:23), it was stated that the duration of people suffering from diabetes also affects the increased risk of hypertension where people who have diabetes for 5-10 years are at risk of 3 times suffering from hypertension. Diabetes can trigger the onset of plaque in large blood vessels (atherosclerosis). The impact caused by plaque is that blood flow will be narrowed so that it requires higher pressure in the blood circulation process in the body (Haydeh Hashemizadeh, 2013).

Hypertension is a factor that can result in micro and macrovascular complications in people with diabetes mellitus (Arshad, A. R., Tipu, H. N. and Paracha, 2016). Stress is considered a psychological factor that can increase blood pressure. If this condition continues for a long period of time without proper treatment, it can result in high blood pressure will be difficult to control (Afifah, 2018). Stress conditions in patients with diabetes mellitus can affect the control of blood sugar levels. Uncontrolled blood sugar levels in the long term can result in hyperglycemia which leads to complications (Nasriati, 2013).

Patients with diabetes mellitus with hyperglycemia are caused by uncontrolled blood sugar levels so that it can cause hypertension, apart from hyperglycemia, hypertension can also be affected by stress because it can increase heart rate and breathing (Mutmainah, 2013).

ABI value in patients with type 2 diabetes mellitus.
The results showed the value of ABI/Blood circulation in the status of mild obstruction perfusion or in the value of 0.71 – 0.89 with 33 respondents (100%).

The researcher assumes that the factors that affect ABI abnormalities in individuals with diabetes mellitus are gender, age, race, duration of DM, blood pressure, physical activity, and smoking status. At the value of a mild obstruction, it indicates a narrowing of the arterial blood vessels that causes blood flow to the lower extremities to be slightly reduced, but usually does not cause serious clinical symptoms. The occurrence of mild obstruction is most likely caused by the length of time a person suffers from type 2 diabetes mellitus, this can aggravate the complications of type 2 diabetes mellitus because a prolonged increase in blood glucose levels results in damage to the lumen of blood vessels, so that there is more tissue damage and one of them is blood vessel circulation disorders.

The results of the study on DM respondents are in line with the results of the study conducted by Thendria et al where in the study ABI abnormalities were most commonly found at the age of 60-69 years. The physiological aging process results in blood vessels being more at risk of developing atherosclerosis. Inflammatory, endothelial, and smooth muscle cells of blood vessels in old age differ from younger ages.

The length of the duration of diabetes indicates how long the patient has had diabetes mellitus since the diagnosis of the disease was established. The duration of diabetes mellitus is associated with the risk of several complications that arise afterwards (Abiyoga, 2021). According to research (Kartikadewi et al., 2022) states that most cases of type 2 diabetes mellitus will experience ABI abnormalities after the course of the disease >4 years.

Type II diabetes mellitus is called insulin-dependent diabetes mellitus and occurs due to decreased insulin sensitivity (insulin resistance) and impaired insulin secretion (Black & Hawks, 2014). This is due to a

decrease in insulin's ability to stimulate glucose uptake by peripheral tissues. Cells are not able to fully compensate for insulin resistance, which means that there is a relative insulin deficiency, or it can be said that pancreatic cells are desensitized to glucose, resulting in a buildup of glucose in the blood (hyperglycemia) (Guyton, 2012). The condition of hyperglycemia that is not managed properly for a long time makes people with Diabetes Mellitus very susceptible to chronic vascular complications, namely disruption of the flow of blood vessels to the legs. Hyperglycemia will affect the function of blood platelets which can cause blood clots, so people with type 2 diabetes mellitus will be at risk of developing peripheral artery disease which usually often attacks the lower extremities, namely the leg organs (Kohlman & Trigoboff, 2013).

CONCLUSIONS AND SUGGESTIONS

The results of this study can be concluded that the factors that affect ABI in the DM group are age and physical activity, while in the non-DM group it is physical activity. It is hoped that further research can be carried out on larger sampling and using more accurate methods, using instruments that can show accurate results such as vascular doppler, it is hoped that further studies the factors that affect ABI in DM patients.

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