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Prevalence Of Diabetic Foot Ulcers In Patients With Type 2 Diabetes Mellitus

Muh Vikram[1], Dararianí Iskandar[2], Ardiyanto[3], Hasan[3], Muh Jabal Nur[2]

[1]*Student of Doctor Profession Program, Faculty of Medicine, Indonesian Muslim University, Makassar, Indonesia*
[2]*Clinical Educator Doctor in Internal Medicine at Ibnu Sina Makassar Hospital, South Sulawesi, Indonesia*
[3]*Clinical Educator Doctor in Internal Medicine at Makassar City Hospital, South Sulawesi, Indonesia*

**Corresponding Author: Muh Vikram*
E-mai: vikram250216@gmail.com

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Abstract

Diabetes mellitus is a chronic metabolic disease characterized by elevated blood glucose levels. Approximately 422 million people worldwide suffer from diabetes, with a high prevalence in low- and middle-income countries. According to the 2018 consensus of the Indonesian Endocrinology Association (PERKENI), the prevalence of diabetes in individuals aged ≥15 years is 2%. This research is a descriptive retrospective study with a cross-sectional approach aimed at describing the characteristics of diabetic foot ulcer patients in the outpatient unit. Data was obtained from the medical records of Ibnu Sina Hospital, with a sample size of 88 patients. Based on the research findings, diabetic foot ulcers are more commonly found in women (61.4%), as well as in individuals with normal nutritional status (55.7%) and those in the hypertension grade 1 group (58.0%). Most patients have a final education level of elementary school or equivalent (44.3%) and work as housewives (40.9%). The majority of diabetic foot ulcer patients are from the late elderly age group (56–65 years) and are female. Most of the patients had normal nutritional status, grade 1 hypertension, an elementary school or equivalent education, and worked as housewives.

Introduction

Diabetes mellitus is a chronic metabolic disease characterized by high blood glucose levels. If not managed properly, this disease can trigger various serious problems in the body's organs. The most common type is type 2 diabetes mellitus, which occurs when the body does not respond to insulin effectively or does not produce enough insulin, and this condition mainly occurs in adults. In recent decades, the prevalence of type 2 diabetes mellitus has increased significantly, particularly in developing countries (WHO, 2023).

It is estimated that there are about 422 million people in the world suffering from diabetes, with the majority in low- to middle-income countries. Diabetes mellitus causes about 1.6 million deaths each year, and the number of cases is growing. According to a consensus from the Indonesian Endocrinology Association (PERKENI) in 2018, the prevalence of diabetes mellitus in the population aged ≥15 years reached 2%, an increase from 1.5% in 2013. South Sulawesi ranks 16th in the province with the highest prevalence, reaching 1.7% in 2018, while Makassar City has the highest number of cases in the province, namely 27,004 cases in 2019

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(Ministry of Health of the Republic of Indonesia, 2020; Government of the Republic of Indonesia, 2018; WHO, 2023; Widyastuti et al., 2023).

Uncontrolled diabetes mellitus can lead to various complications that affect all organs of the body, which reduces the function and quality of life of the sufferer. These complications include retinopathy, neuropathy, and diabetic foot, which require medical care to maintain the patient's health. Diabetic ulcers are a common complication of diabetes mellitus, and sufferers have a 29 times higher risk of developing such ulcers, with a 15-25% chance of developing a diabetic ulcer in life and a recurrence rate of 50-70% within five years. These ulcers are wounds that arise as a result of disorders of nerves, blood vessels, and infections, with data showing one case of diabetic ulcer-related amputation occurs every 30 seconds in the world (Fitriani, 2021; Sasmiyanto, 2019).

The mortality rate from diabetic ulcers and gangrene ranges from 17-23%, and the amputation rate reaches 15-30%. Amputees had a mortality rate of 14.8% in one year post-amputation, with an average life expectancy of just 23.5 months. It emphasizes that diabetic ulcers are a serious condition that affects the health and life expectancy of patients with diabetes mellitus, so the treatment and prevention of diabetic ulcers is very important in the management of diabetes to lower the risk of complications and improve the quality of life of patients (Fitriani, 2021).

Methods

The type of research used is a descriptive retrospective study with a cross sectional approach that provides an overview of the characteristics of Diabetic Ulcer patients based on secondary data from medical records at Ibnu Sina Hospital. The population in this study is 88 patients who have been diagnosed with Diabetic Foot Ulcers and have medical records at Ibn Sina Hospital. The number of samples in this study uses the Total Sampling method. Total sampling is a sampling technique by taking all members of the population of diabetic foot ulcers at Ibn Sina Hospital.

Result and Discussion

Research Results

This study was conducted at Ibnu Sina Hospital Makassar regarding the prevalence of Diabetic Foot Ulcers in Patients with Type 2 Diabetes Mellitus in 2023. The collection of research samples was carried out in August of July 2024. This study was carried out by taking secondary data from the medical records of Diabetic Ulcer patients registered in the inpatient unit at Ibnu Sina Hospital Makassar in 2023. The total sample in this study is as many as 88 samples that can be studied for their characteristics. The results of this study will be presented in the form of tables and bar charts/pie charts.

Based on the results of a study on the prevalence of diabetic foot ulcer patients at Ibnu Sina Hospital in 2023, the distribution of proportions based on age was obtained as follows:

Table 1. Distribution of the Proportion of Diabetic Foot Ulcer Patients at Ibnu Sina Hospital Makassar in 2023 by Age Group

Age (Years)	Frequency	%
Early Adulthood (26-35)	2	2.3
Late Adulthood (36-45)	4	4.5
Early Seniors (46-55)	34	38.6
Late Elderly (56-65)	37	42.0
Seniors (>65)	11	12.5
Total	**88**	**100**

Source: Medical Record Data of Ibnu Sina Hospital Makassar in 2023

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Based on table 1, it can be seen that of the 88 samples/patients with diabetic foot ulcers diagnosed by doctors, based on age, the highest proportion is in the Late Elderly age group (56-65 years), which is 37 patients (42.0%), followed by the early elderly group (46-55 years), which is 34 patients (38.6%), the Elderly group (>65 years), which is 11 patients (12.5%), the late adult group (36-45 years) is as many as 4 patients (4.5%) and the lowest proportion in the early adult group (26-35 years) is as many as 2 patients (2.3%).

Table 2. Distribution of Proportion of Diabetic Foot Ulcer Patients at Ibnu Sina Hospital Makassar in 2023 by age

Gender	Frequency	%
Man	34	38.6
Woman	54	61.4
Total	**88**	**100**

Source: Medical Record Data of Ibnu Sina Hospital Makassar in 2023

Based on table 2, it can be seen that of the 88 samples/patients with diabetic foot ulcers diagnosed by doctors, based on gender, the highest proportion is in female patients, which is 54 patients (61.4%), while in male patients, there are 34 patients (38.6%).

Table 3. Distribution of the Proportion of Diabetic Foot Ulcer Patients at Ibnu Sina Hospital Makassar in 2023 based on BMI

Age (Years)	Frequency	%
Underweight	25	28.4
Usual	49	55.7
Overweight	12	13.6
Obesity I	2	2.3
Obesity II	0	0
Total	**88**	**100**

Source: Medical Record Data of Ibnu Sina Hospital Makassar in 2023

Based on table 3, it can be seen that of the 88 samples/patients with diabetic foot ulcers diagnosed by doctors, based on BMI, the highest proportion is in the group of patients with normal nutritional status, which is 49 patients (55.7%), the group of patients with underweight nutritional status, which is 25 patients (28.4%), then the group of patients with overweight nutritional status, which is as many as 12 patients (13.16%), and the lowest proportion in the group of patients with nutritional status of Obesity I, which is as many as 2 patients (2.3%).

Table 4. Distribution of the Proportion of Diabetic Foot Ulcer Patients at Ibnu Sina Hospital Makassar in 2023 based on Blood Pressure

Age (Years)	Frequency	%
Usual	17	19.3
Pre-Hypertension	16	18.2
Grade *1* hypertension	51	58.0
Grade *2* hypertension	4	4.5
Total	**88**	**100**

Source: Medical records of Ibnu Sina Hospital Makassar in 2023

Based on table 4, it can be seen that of the 88 samples/patients with diabetic foot ulcers diagnosed by doctors, based on blood pressure, the highest proportion is in the group of patients with blood pressure in the grade 1 hypertension group, which is 51 patients (58.0%), the group of patients with normal blood pressure, which is 17 patients (19.3%), then the group of patients with pre-hypertensive blood pressure, which is 16 patients (18.2%), and the lowest proportion

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in the group of patients with grade 2 hypertension blood pressure, which is as many as 4 patients (4.5%).

Table 5. Distribution of the Proportion of Diabetic Foot Ulcer Patients at Ibnu Sina Hospital Makassar in 2023 Based on Education Level

Age (Years)	Frequency	%
Elementary School	39	44.3
Junior School	18	20.5
High School	27	30.7
College	4	4.5
Total	**88**	**100**

Source: Medical Record Data of Ibnu Sina Hospital Makassar in 2023

Based on table 5, it can be seen that of the 88 samples/patients with diabetic foot ulcers diagnosed by doctors, based on the level of education, the highest proportion is in the group of patients with the last education in the elementary school group, which is 39 patients (44.3%), the group of patients with the level of high school education, which is 27 patients (37.0%), then the group of patients with the first secondary school education level, which is as many as 18 patients (20.5%), and the lowest proportion in the group of patients with a level of higher education, which is as many as 4 patients (4.5%).

Table 6. Distribution of the Proportion of Diabetic Foot Ulcer Patients at Ibnu Sina Hospital Makassar in 2023 based on work

Age (Years)	Frequency	%
Civil servants	3	3.4
Housewife	36	40.9
Self employed	16	18.2
Farmers/Workers	22	25.0
Not working/retiring	8	9.1
Others	3	3.4
Total	**88**	**100**

Source: Medical Record Data of Ibnu Sina Hospital Makassar in 2023

Based on table 6, it can be seen that of the 88 samples/patients with diabetic foot ulcers diagnosed by doctors, based on occupational work, the highest proportion is in the group of patients with IRT work, which is 36 patients (40.9%), the group of patients with farmer/labor jobs, which is as many as 22 patients (25.0%), then the group of patients with self-employed jobs, which is 16 patients (18.2%), and the least proportion in the group of patients with civil servant and other jobs, namely as many as 3 patients (3.4%).

Diabetes Mellitus (DM) is a chronic disease condition characterized by an increase in blood glucose levels beyond normal limits, which can be observed with blood glucose levels greater than or equal to 200 mg/dL, or fasting blood glucose levels greater than or equal to 126 mg/dL (Hestiana, 2017).

Criteria for diagnosis of DM according to the American Diabetes Association 2022 (Diabetes Care, 2022): 1) Fasting plasma glucose test ≥126 mg/dL (7.0 mmol/L). Fasting is a condition in which there is no calorie intake for at least 8 hours, or; 2) Plasma glucose test ≥200 mg/dL (11.1 mmol/L) 2 hours after Oral Glucose Tolerance Test (TTGO) with a glucose load containing the equivalent of 75 grams of anhydrous glucose dissolved in water, or; 3) A1c test ≥ 6.5% (48 mmol/mol). Testing should be performed in a laboratory using methods that are certified by the National Glycohaemoglobin Standardization Program (NGSP) and standardized for Diabetes Control and Complications Trial (DCCT) testing; 4) Patients with

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classic symptoms of hyperglycemia or hyperglycemic crisis, with plasma glucose testing at ≥ 200 mg/dL (11.1 mmol/L).

Diabetic ulcers are a chronic complication of diabetes mellitus that appears as open sores on the skin, often accompanied by necrosis of the tissue around the affected area. These wounds are caused by macroangiopathic disorders, which inhibit the blood supply to the area, as well as neuropathy. As a result of this condition, sufferers are often unaware of the existence of the wound or the severity of the wound, which can then develop into an infection due to aerobic or anaerobic bacteria (Hastuti, 2008).

Diabetic foot is a serious but under-researched global health problem in terms of its epidemiology. The prevalence of diabetic foot ulcers globally is higher in men than women, as well as higher in type 2 diabetic patients compared to type 1. North America has the highest prevalence, while Oceania has the lowest prevalence. Diabetic foot ulcers are also more common in elderly patients, those who have a lower body mass index, have had diabetes for a longer period of time, and have a history of hypertension, diabetic retinopathy, and smoking habits (Zhang et al., 2017).

Based on Table 1, the results of this study are consistent with the research conducted by Nurlana Zamaun in 2024, which shows that diabetic foot ulcers are most commonly found in the age group of 45-59 years, with the number of cases as many as 20 (58.8%). This study adopts the theory of aging which states that aging takes place slowly and is divided into several stages. The transition stage occurs at the age of 35-45 years, during which symptoms of a decline in the body's physiological functions begin to appear and can manifest themselves in various diseases. The clinical stage, which begins at age 45 and older, is characterized by a decline in the functioning of all body systems, including the immune, metabolic, endocrine, sexual and reproductive, cardiovascular, gastrointestinal, muscular, and nervous systems. At this stage, degenerative diseases begin to be diagnosed, resulting in a decrease in quality of life due to severely disrupted physical and psychological disabilities. These findings are also supported by the research of Sharma (2015), which found that the age group of 51-60 years is the group that suffers the most from diabetes mellitus (Arania, Triwahyuni, Esfandiari, et al., 2021; Nurlana Zamaun et al., 2024).

According to the American Diabetes Association (ADA), the risk of type 2 diabetes mellitus increases with age. This increased risk has to do with an increase in the composition of body fat, specifically those that accumulate in the abdominal area (central obesity), which in turn triggers insulin resistance, which is a major factor in the development of type 2 diabetes mellitus (Gunawan & Rahmawati, 2021).

Age is also a risk factor for diabetes mellitus that cannot be modified. In women, menopause that occurs at the age of 40-45 accelerates the decline in estrogen production and increases insulin resistance. The sooner a woman goes through menopause, the greater the risk of developing type 2 diabetes mellitus. After menopause, metabolic disorders, obesity, and changes in steroid hormones increase the incidence of metabolic syndrome, type 2 diabetes, cardiovascular disease, and malignancy. Fahmi's (2015) research also supports this finding by stating that the peak incidence of diabetic ulcers occurs at the age of 50-60 years (Fahmi, 2015; Fitria et al., 2017; Khairunisa, 2022).

Decreased body functions related to aging can lead to chronic inflammation, slow down the wound healing process, and reduce the ability of cells to regenerate. These include reduced function of the pancreas as an insulin producer and decreased capacity of fibroblasts in the skin, which reduces the tissue's ability to regenerate. All these factors contribute to the high prevalence of diabetic ulcers in the elderly group (Khairunisa, 2022).

Based on Table 2, the results of this study are in line with research conducted by Rosita in 2022, which used the chi square test in bivariate analysis for sex. The results showed that there

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was a relationship between sex and type 2 diabetes mellitus with a p-value of 0.012 ($p < 0.05$). The Prevalence Odds Ratio shows that women are 2.15 times more at risk of developing type 2 diabetes mellitus compared to men. This study reinforces the finding that female patients are more at risk of developing diabetic ulcers at the age of more than 45 years, because at that age women enter menopause. During menopause, decreased estrogen formation leads to a decrease in the elasticity of blood vessels, which increases the risk of atherosclerosis and hypertension. As described in the literature, this condition can damage blood vessels and trigger macroangiopathy and tissue ischemia, which are associated with the occurrence of diabetic ulcers (Khairunisa, 2022; Rosita et al., 2022).

In addition, the use of contraceptive pills can also be an additional risk factor for women to develop diabetic ulcers. There is a close association between the use of contraceptive pills and an increased incidence of type 2 diabetes mellitus in women over 35 years of age. Women who use the pill are 16 times more likely to develop type 2 diabetes mellitus compared to those who do not use it, which in turn increases the risk of developing diabetic ulcers (Khairunisa, 2022).

However, the results of this study are different from the study of Chomi and Nuneza (2015), which found that the number of diabetic ulcer cases was higher in men, with a ratio of 1.4:1. They explained that the high number of diabetic ulcers in men is due to the lack of visits by men to the doctor for consultation compared to women, as well as the limited information obtained about their condition when visiting health services. This difference in results may be due to the limited number of subjects and the short time of data collection, which cannot describe the general distribution of sexes (Chomi, 2015).

Based on Table 3, the results of this study are in line with the research conducted by Fahmi (2015) at the Cengkareng Regional Hospital, which showed that diabetic ulcer patients with a normal Body Mass Index (BMI) recorded the highest number of 64.4%. A similar study by Chomi et al. (2014) also found that the group with a normal BMI reached 48% (Chomi, 2015; Fahmi, 2015).

However, the results of this study are not entirely in line with the theory that obesity is one of the triggering factors for hypertension and high blood fat levels. High blood fat levels can accelerate the process of atherosclerosis, which can inhibit blood circulation to various organs and increase the risk of microvascular complications, such as retinopathy and nephropathy, as well as macrovascular complications such as arterial disease and coronary heart disease. In addition, neuropathy is often a complication that arises as a result of problems in the microvascular and macrovascular vessels. Obesity can also increase pressure on the soles of the feet, which makes it easier to develop calluses, which in turn can worsen the condition of diabetic ulcers (Khairunisa, 2022).

Based on Table 4, the results of this study are in line with a study conducted by Luthia Khairunisa in 2022, which showed that diabetic ulcer patients with grade 1 hypertension status were the most common group compared to other blood pressure levels, with a total of 42 patients (42%).

People with diabetes mellitus (DM) accompanied by hypertension have a higher risk of developing diabetic ulcers. Hypertension in DM patients can lead to complications such as coronary heart disease (CHD), stroke, nephropathy, and retinopathy. Vascular disorders that occur in people with DM and hypertension can impede blood flow, especially in limbs such as the legs, which are susceptible to disorders, including diabetic ulcers. In DM patients accompanied by hypertension, the most common complaints are tingling legs and even blockages in blood vessels. Hypertension in type 2 DM is also triggered by hyperglycemia, which increases the production of angiotensin II, which plays a role in the occurrence of hypertension. Therefore, in patients diagnosed with DM and hypertension, primary prevention is very important, one of which is with foot care to prevent complications of circulatory

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disorders (Khairunisa, 2022). Based on Table 5, the results of this study are in line with research conducted by Resti Arania in 2021, which showed that respondents with primary education reached 60 people (47.6%), secondary education as many as 34 people (27.0%), and tertiary education as many as 32 people (25.4%).

There are two factors that affect a person's knowledge, namely internal and external factors. Internal factors include education, employment, and age, while external factors include environmental and socio-cultural. Education has an important role in improving one's knowledge, especially in obtaining information related to health, which in turn can improve the quality of life. In this study, respondents obtained information about their illness through medical personnel, such as nurses or doctors who examined them. The knowledge possessed is very influential in the prevention of diabetic foot wounds (Arania, Triwahyuni, Prasetya, et al., 2021; Suryati et al., 2019).

The results of this study are also in line with Agista (2017) research, which shows a relationship between the level of knowledge about diabetic foot ulcers and efforts to prevent the occurrence of these wounds. The results of the analysis using the rank-spearman test showed a value of $p = 0.001$, which indicates that the Zero (Ho) hypothesis was rejected ($p < 0.05$) (Tapestry & Maliya, 2017). Diabetic foot wounds are a common complication that occurs in people with diabetes mellitus and often cause fear of possible amputation, especially in cases of severe ulcers and uncontrolled blood sugar levels. One of the factors closely related to the incidence of diabetic foot wounds is maladaptive behavior, such as the patient's non-compliance in preventing diabetic foot ulcers. Prevention of diabetic foot ulcers through foot care in people with diabetes mellitus is one of the important steps to reduce the risk of such wounds (Suryati et al., 2019).

Based on Table 6, the results of this study are in line with the research conducted by Resti Arania in 2021, which showed that the results of the analysis of the relationship between work and the incidence of diabetes mellitus obtained a p-value = 0.002. This shows a weak correlation between work and the incidence of diabetes mellitus, with a correlation value of -0.273. This indicates that a person who does work with high physical activity has a lower risk of developing diabetes mellitus (Arania, Triwahyuni, Prasetya, et al., 2021; Khairunisa, 2022).

Work in fulfilling the needs of life can be measured by the type of work a person undertakes, whether working as a farmer, trader, civil servant, teacher, self-employed, laborer, or housewife. This work environment can be a risk to health, either directly or indirectly, including in this case the risk of developing diabetes mellitus. Occupational factors affect the risk of diabetes mellitus; Work with low or light physical activity can lead to less than optimal energy burning, so excess energy will be stored in the form of body fat that causes obesity. Obesity itself is one of the main risk factors for diabetes mellitus (Khairunisa, 2022).

Based on the type of job, a person with a job with minimal physical activity, irregular eating schedule, and lack of sleep, can have a higher risk of developing diabetes mellitus. Sleep deprivation can disrupt the balance of hormones that regulate appetite and the body's energy balance. Conversely, individuals who work as farmers or field laborers, who require a lot of manpower and energy in their work activities, can help improve muscle glucose recovery. This high physical activity can accelerate the absorption of glucose from the bloodstream into the muscles, thus reducing the accumulation of body fat that risks leading to obesity, which in turn lowers the risk of diabetes mellitus (Khairunisa, 2022).

Conclusion

From the results of the research obtained regarding the prevalence of diabetic foot ulcers at Ibnu Sina Hospital Makassar in 2023, it can be concluded as follows: 1) The most diabetic foot ulcer patients based on age are patients with the Late Elderly age group (56 - 65 years); 2) The most diabetic foot ulcer patients by gender are female patients; 3) Diabetic foot ulcer patients

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based on BMI are most likely patients with normal nutritional status; 4) The most diabetic foot ulcer patients based on blood pressure are in patients with grade 1 hypertension; 5) Diabetic foot ulcer patients based on the level of education are the most educated patients with the last education of elementary school/equivalent; 6) Diabetic foot ulcer patients by occupation are the most employable patients who work as IRTs.

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