Omni Health Journal
e-ISSN: xxxx-xxxx, p-ISSN: xxxx-xxxx
Volume 1 Issue 1: page (30- 39), April 2024
DOI link

Original Research

Factors Influencing the Incidence of Diabetic Diabetic Foot Injuries in Makassar City

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Article Info

Article History:
Received: 27-04-2024
Revised: 29-04-2024
Accepted: 29-04-2024

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Abstract

Background: Diabetics who do not pay attention to the type of food consumed will make blood glucose levels uncontrolled, besides that the environment is one of the factors that make health disrupted such as an environment that is often exposed to cigarette smoke, even though cigarettes can interfere with the body's metabolic processes and will affect insulin production. One of the complications that can occur is neuropathy or lack of sensitivity to the nerves which leads to the formation of diabetic foot wounds, when wounds form, they heal or not depending on the wound care process. However, with the principle of wound care, moisture balance has been effective in the wound healing process.
Objective: This study aims to determine the factors that influence the incidence of diabetic foot injuries in Makassar City.
Methods: Quantitative with cross sectional approach. The sample of this study was 34 samples obtained by purposive sampling technique. Data collection was carried out using questionnaires and analyzed using the chi-square test.
Results Based on the study, the factors that affect the incidence of diabetic foot injuries are: age obtained p value = 0.015 (<α0.05), Gender obtained p value = 0.020 (<α0.05), Work obtained p value = 0.025 (<α0.05), Long suffering from DM obtained p value = 0.000 (<α0.05), Drug obtained p value = 0.002 (<α0.05), Obesity obtained p value = 0.008 (<α0.05).
Conclusion: The conclusion in this study is that factors that influence the incidence of diabetic foot injuries are age, sex, occupation, length of suffering from DM, medication adherence, obesity

Keywords: Diabetes Mellitus; Diabetic Foot Ulcer Degree; Diabetic Foot Ulcer

Introduction

Diabetes mellitus is a health problem in the world that continues to increase The prevalence every year, this is due to unhealthy lifestyle changes. This is in line with data from the International Diabetes Federation (IDF) in 2021 experiencing a significant increase, namely there are 527 million people diagnosed with diabetes. This figure is up 16% or 74 million inhabitants since IDF data estimates in 2019. This number is predicted to increase to 643 million people in 2030 and 784 million people in 2045 (Razdkanya, 2021).

Diabetes mellitus sufferers who are increasing in number every year mostly come from developing countries, one of which is Indonesia which ranks seventh highest in the world after China, India, USA, Brazil, Russia and Mexico (Megawati et al, 2020). In 2021, Indonesia ranks fifth with the number of people with diabetes mellitus in the world, which is 19.47 million people (10.6%) (Razdkanya, R. 2021). Diabetes mellitus becomes a serious health problem and even continues to increase the number of sufferers every year, along with increasing population, increasing age, increasing unhealthy lifestyles, unhealthy diets, unhealthy diets and obesity (Ministry of Health, 2018).

Based on Basic Health Research data (2018) the prevalence of diabetes mellitus in South Sulawesi Province is the highest with an increase of 26% (Riskesdas, 2018). Based on data from the 2015 health profile, the prevalence of diabetes diagnosed by doctors or based on symptoms was 17,843 people, which is the highest in Toraja 1,088 cases (6.1%), due to cold weather conditions with temperatures of 16-25ºC which make people feel hungry quickly, so they consume food uncontrollably, Makassar 945 (5.3%), Makassar in 2016. i.e. 26,245 cases (Latief, M. 2016). This happens because of

the increase in per capita opinion and lifestyle changes, especially in big cities, public awareness of the importance of a healthy diet is getting lower, people tend to only consider the taste, aesthetics of food to be uploaded on social media without paying attention to the nutrients or content contained in the food, the more processed carbohydrate-based foods can be found easily and become a source of cause increased blood sugar. In addition, the environment is one of the factors that make health disrupted such as an environment that is often exposed to cigarette smoke, even though cigarettes can interfere with the body's metabolic processes and will affect insulin production (Latief, M. 2016).

DM sufferers who do not pay attention to the type of food consumed will make blood glucose levels uncontrolled, one of the complications that can occur is neuropathy or lack of sensitivity to the nerves which leads to the formation of diabetic foot wounds, when wounds form in DM sufferers, then healing or not depends on the wound care process (Latief, M. 2016). The lower middle class community conducts wound care in a traditional way based on previous understandings that use the principles of wound care by utilizing traditional medicinal plants, and on the grounds that the cost of treatment is more expensive (Andas et al., 2022).

Along with the process of wound care in traditional ways that are less effective so that the wounds experienced do not heal (Pohan, S. I. 2015); (Mamik, M. N. 2015). It can be found from the results of data or reasons for visits from medical records at ETN Center it can be seen that patients who come to visit with severe wound conditions, and many are already at risk of amputation, but with modern wound care principles, wound care with moisture balance principles is more effective in the wound healing process (Temu, S., Sujianto, U., Nur, M. 2020). The data on the incidence of diabetes mellitus wounds at the ETN Center Makassar Care Center from January to December 2021 was 92 cases, while the latest data on the number of DM wound patients from January to May 2022 was 43 cases.

From the explanation above, researchers are interested in researching the factors that affect the incidence of injuries of diabetics at the ETN Center Makassar Care Center in 2022.".

Methods

Study Design

The type of research that is an analytical survey with a cross-sectional study research design, which is a type of research that emphasizes the time of measurement/observation of independent variable data and dependent variables only once at a time (Nursalam, 2017).

Samples/Participants

The population in this study was all Diabetes Mellitus sufferers in the ETN Centre Makassar Care Center as many as 43 people in January-May 2022. Sampling in this study uses purposive sampling techniques, namely by taking the entire population with a specific purpose that has something in common. (Notoatmodjo, 2018).

Instruments

The instrument used to collect data in this study was a questionnaire. The form of questions in this questionnaire is a closed question that respondents must answer by choosing the answers that have been provided.

Data Collection

Data collection was carried out in three places, namely ETN Centre Makassar Care House, Labuang Baji Hospital Makassar, and Maccini Sawah Health Center Makassar City.

Data Analysis

Univariate analysis is carried out analysis of a variable that is measured at a certain time. Bivariate analysis is the analysis of data on two variables that express the influence between these variables. In this study, bivariate analysis was carried out to determine the factors that affect the incidence of wounds in diabetics using an ordinal scale (Swarjana, 2016).

Ethical Considerations

Informed consent is given prior to the study. Form of agreement between researchers and research respondents by providing approval sheets to become respondents and not giving or not including respondents' names on measuring instrument sheets and only writing codes on data collection sheets.

Results

Univariate Analysis

Table 1 Frequency Distribution Respond By Age

Age	Frequency	Percentage (%)
36-45 Year	4	11,8
46-55 Year	18	52,9
56-65 Year	12	35,3
Total	34	100,0

Source: Primary Data

Table 2 Frequency Distribution Respond By gender

Gender	Frequency	Percentage (%)
Woman	20	58,8
Man	14	41,2
Total	34	100,0

Sumber: Data Primer

Table 3 Distribution of Respondent Frequency by occupation

Work	Frequency	Percentage (%)
Does not work	2	5,9
IRT	20	58,8
Private	7	20,6
Past Workers	5	14,7
Total	34	100,0

Source: Primary Data

Table 4 Frequency Distribution Respond based on Length of Suffering from DM

Long Suffering from DM	Frequency	Percentage (%)
<5 Year	11	32,4
>5 Year	23	67,6
Total	34	100,0

Source: Primary Data

Table 5 Frequency Distribution Respondents based on Adherence to taking medication

Adherence to taking medication	Frequency	Percentage (%)
Orderly	5	14,7
Disorganized	29	85,3
Total	34	100,0

Source: Primary Data

Table 6 Frequency Distribution of Respondents Based on the drugs used

Drugs used	Frequency	Percentage (%)
Metformin	29	85,3
Glimepirid+Metformin	5	14,7
Total	34	100,0

Source: Primary Data

Table 7 Frequency Distribution of Respondents by smoking

Smoke	Frequency	Percentage (%)
Yes	6	17,6
No	28	82,4
Total	34	100,0

Source: Primary Data

Table 8 Frequency Distribution based on number of cigarettes consumed

Number of cigarettes consumed	Frequency	Percentage (%)
>20 sticks per day	6	17,6
No smoking	28	82,4
Total	34	100,0

Source: Primary Data

Table 9 Frequency Distribution of respondents By obese

Obese	Frequency	Percentage (%)
Obese	25	73,5

Normal	9	26,5
Total	34	100,0

Source: Primary Data

Table 10 Frequency Distribution of Respondents Based on Decline BB for 3 months

BB decline over the past 3 months	Frequency	Persentase (%)
There is a decrease	9	26,5
No drop	25	73,5
Total	34	100,0

Source: Primary Data

Table 11 Frequency Distribution of Respondents Based on events diabetic foot wounds

Incidence of Diabetic Foot Injuries	Frequency	Percentage (%)
Grade 2	11	32,4
Grade 3	14	41,2
Grade 4	9	26,5
Total	34	100,0

Source: Primary Data

Analisis Bivariat

Table 12 Distribution of Age Effects on Incidence of diabetic foot injuries

Usia	Incidence of diabetic foot wounds						Total		P value
	Grade 2		Grade 3		Grade 4				
	n	%	n	%	n	%	n	%	
36-45 Years	3	75,0	1	25,0	0	0,0	4	100	0.015
46-55 Years	6	33,3	10	55,6	2	11,1	18	100	
56-65 Years	2	16,7	3	25,0	7	58,3	12	100	
Total	**11**	**32,4**	**14**	**41,2**	**9**	**26,5**	**34**	**100**	

Table 13 Distribution of Influence of sex on Incidence of diabetic foot injuries

Gender	Incidence of diabetic foot wounds						Total		P value
	Grade 2		Grade 3		Grade 4				
	n	%	n	%	n	%	n	%	
Woman	4	20,0	12	60,0	4	20,0	20	100	0.020
Man	7	50,0	2	14,3	5	35,7	14	100	
Total	**11**	**32,4**	**14**	**41,2**	**9**	**26,5**	**34**	**100**	

Table 14 Distribution of Occupational Effect on Incidence of diabetic foot injuries

Work	Incidence of diabetic foot wounds						Total		P value
	Grade 2		Grade 3		Grade 4				
	n	%	n	%	n	%	n	%	
Does not work	1	50,0	0	0,0	1	50,0	2	100	0.015
IRT	4	20,0	12	60,0	4	20,0	20	100	
Private	2	28,6	1	14,3	4	57,1	7	100	
Past Workers	4	80,0	1	20,0	0	0,0	5	100	
Total	**11**	**32,4**	**14**	**41,2**	**9**	**26,5**	**34**	**100**	

Table 15 Distribution of the Effect of long suffering from DM on kejadian diabetic foot wounds sufferer diabetes

	Incidence of diabetic foot wounds

Long suffering from DM	Grade 2		Grade 3		Grade 4		Total		P value
	n	%	n	%	n	%	n	%	
<5 Years	10	90,9%	1	9,1%	0	0,0%	11	100	0.000
>5 Years	1	4,3%	13	56,5%	9	39,1%	23	100	
Total	**11**	**32,4**	**14**	**41,2**	**9**	**26,5**	**34**	**100**	

Table 16 Distribution of Effect of drugs on incidence diabetic foot wounds

MEDICINE	Incidence of diabetic foot wounds						Total		P value
	Grade 2		Grade 3		Grade 4				
	n	%	n	%	n	%	n	%	
Orderly	5	100,0%	0	0,0%	0	0,0%	5	100	0.002
Disorganized	6	20,7%	14	48,3%	9	31,0%	29	100	
Total	**11**	**32,4**	**14**	**41,2**	**9**	**26,5**	**34**	**100**	

Table 17 Distribution of the Effects of Smoking on Incidence of diabetic foot injuries

Smoke	Incidence of diabetic foot wounds						Total		P value
	Grade 2		Grade 3		Grade 4				
	n	%	n	%	n	%	n	%	
Smoke	1	16,7%	2	33,3%	3	50,0%	6	100	0.335
No smoking	10	35,7%	12	42,9%	6	21,4%	28	100	
Total	**11**	**32,4**	**14**	**41,2**	**9**	**26,5**	**34**	**100**	

Table 18 Distribution of the Effect of obesity on the incidence diabetic foot wounds

Smoke	Incidence of diabetic foot wounds						Total		P value
	Grade 2		Grade 3		Grade 4				
	n	%	n	%	n	%	n	%	
Obese	5	20,0%	11	44,0%	9	36,0%	25	100	0.008
Normal	6	66,7%	3	33,3%	0	0,0%	9	100	
Total	**11**	**32,4**	**14**	**41,2**	**9**	**26,5**	**34**	**100**	

Discussion

The effect of age on the incidence of diabetic foot injuries

Based on table 1, the results of the study of respondents who experienced diabetic foot injuries were more common at the age of 46-55 years as many as 18 (52.9%) respondents. This age includes the classification of early old age, where between late adulthood to early old age. Where this age is at risk of developing diabetes because the body's ability to experience a decrease in pancreatic function as a result of which the function of the pancreas to react to insulin decreases so that blood sugar levels are not controlled. This situation can cause atherosclerosis which has an impact on vasculopathy, resulting in impaired blood circulation in the legs which causes diabetic foot ulcers to easily occur.

This result is in line with research conducted by Saenab, Suhartatik (2020) obtained results that the proportion of type 2 DM patients who experience diabetic ulcers is more prevalent at the age of 46-55, which is 19 (63.3%). The results of statistical tests show a significant relationship between age and the occurrence of diabetic foot ulcers.

The results of the study were supported by Yuliani, Sulaeha, Sukri and Yusuf (2017) that the most age in the study was the age with an average of 54 (43.6%) years which showed a significant relationship between age and the occurrence of diabetic foot ulcers. However, based on table 2 at the age of 56-65, it was more common in degree 4 diabetic foot ulcers as many as 7 (58.3%) respondents, because at that age there began to be an increase in glucose intolerance. Changes begin at the cellular level, continue at the tissue level and at the organ level that can affect homeostatic function. This results in one of the activities of pancreatic beta cells to produce insulin to be reduced and the sensitivity of pancreatic beta cells to produce insulin becomes reduced and cell sensitivity also decreases so that there

is a decrease in secretion or insulin resistance causing the body's ability to function to control high blood glucose less optimally. The older a person is, the longer the healing process because there is a decrease in the regeneration of tissue cells, this is characterized by significant differences in the structure, characteristics of the skin and a decrease in the frequency of epidermal cell replacement.

The influence of sex on the incidence of diabetic foot injuries

Based on the table of research results, respondents who experienced diabetic foot injuries were mostly female, namely 20 (58.8%) respondents based on the number of patient visits at the research site. This is because when women experience menopause, there will be a decrease in the hormones estrogen and progesterone so that they experience impaired blood sugar levels. The existence of these disorders will facilitate the occurrence of diabetic foot injuries, and women have higher triglyceride cholesterol levels than men. The amount of fat in adult females is about 20-25% in adult males between 15-20% of total body weight.

A study conducted by soewondo & pramono (2017) showed that the incidence of DM in Indonesia attacks more women (61.6%). This is triggered by hormonal fluctuations that make fat distribution easily accumulate in the body so that body mass index (BMI) increases with a higher percentage of fat.

This is in line with research conducted by Saenab, Suhartatik (2020) which shows that people with type 2 diabetes mellitus are mostly female 22 (73.3%). The results of statistical tests show a significant relationship between sex and the occurrence of diabetic foot ulcers. The results of this study supported by Fitria, Nur, Marissa and Ramadhan (2017) showed that diabetic foot injury sufferers were dominated by women (54.4%). which shows a significant relationship between sex and the incidence of diabetic foot injuries.

The effect of work on the incidence of diabetic foot injuries

Based on table 3 of the research results, respondents who experienced diabetic foot injuries worked more as housewives, namely 20 (58.8%) respondents, this is based on the number of visits dominated by women. The results of the interview respondents said that they rarely exercise for reasons of laziness to exercise, weakened physique, busy work. Though muscles play a role in absorbing sugar and fat which will be used as energy or energy reserves. When rarely moving, the body will excess energy should energy be converted into glycogen, when muscles are not working excess energy will be converted into fat and stored in the abdominal cavity into fiscal fat. Thus making blood sugar levels in the body increase.

Work describes directly the state of one's health through the work environment both physically and psychologically. In Indonesia, most of the risk of DM occurs in housewives, indicating that the Indonesian population lacks physical activity. Muscles use glucose stored in muscles and if glucose is reduced, muscles fill the void by taking glucose from the blood this will result in decreased blood glucose thereby enlarging blood glucose control (Barnes, 2017).

This is in line with research conducted by Arlin, Afrianti (2020) which shows that people with type 2 diabetes mellitus mostly work as housewives 18 (60%). The results of statistical tests showed a significant relationship between work and the occurrence of diabetic foot ulcers. The results of this study supported by Mustafa, Purnomo and Chatarina (2016) found that most of those suffering from diabetic foot injuries worked as housewives (41.4%) which showed a significant relationship between work and the incidence of diabetic foot injuries (Sari et al., 2022).

Work describes directly the state of one's health through the work environment both physically and psychologically. In Indonesia, most of the risk of DM occurs in housewives, indicating that the Indonesian population lacks physical activity (Amzal Mortin Andas et al., 2020). Muscles use glucose stored in muscles and if glucose is reduced, muscles fill the void by taking glucose from the blood this will result in decreased blood glucose thereby enlarging blood glucose control (Barnes, 2017).

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Continuously initiating cells will change the biochemical homeostasis of the cell which then has the potential to change the basis of the formation of DM complications in the form of retinopathy, nephropathy and diabetic ulcers. The longer you experience diabetes mellitus, the higher the incidence of complications that will be experienced by the patient.

According to Ndraha (2017) damage to blood vessels in the peripheral or in the hands and feet, called Peripheral Vascular Discase (PVD), can occur earlier and the process is faster in diabetics than

those who do not have diabetes. The pulsation of the veins in the legs feels weak or not felt at all. If diabetes lasts for >5 years, PVD will be found followed by nerve disorders or neuropathy and infections that are difficult to heal, patients usually have narrowed heart blood vessels. This is in line with research conducted by Arlin, Afrianti (2020) obtained results that respondents who suffered from DM for a long time >5 years tended to experience more diabetic foot ulcers, which was 33.3% compared to patients <5 years suffering from DM. The results of statistical tests found a significant relationship between the length of suffering from DM and the occurrence of diabetic ulcers with a value of p = 0.027 (<0.050).

The results of this study are supported by research (Husniawati, 2015) on the incidence of ulcers in diabetes mellitus patients, that 60.6% of respondents suffered from DM >5 years. Based on research conducted by (mildawati, 2019) it was found that respondents with a long period of diabetes for more than >5 years as many as 32 people, there is a relationship between the length of suffering from diabetes and the incidence of diabetic peripheral neuropathy.

The effect of drugs on the incidence of diabetic foot wounds adherence to taking medication

Based on table 5, the results of the study of respondents who experienced diabetic foot injuries were more common in respondents who did not regularly take medication as many as 29 (85.3%) respondents. One of the factors of non-adherence to taking medication is busyness in carrying out daily activities makes respondents forget to take medicine, travel, uncomfortable if they have to take medication every day and respondents feel their blood sugar levels are normal, even though the normality or stability of DM patients' sugar levels is affected by the drugs they take. If the respondent is more obedient in taking anti-diabetic drugs, his blood sugar will be more controlled, but if the patient is not obedient in taking anti-diabetic drugs then vice versa, his blood guka becomes uncontrolled. This can be a reference if blood sugar is controlled then the risk of experiencing complications can be prevented.

According to the American Journal of Pharmacy Benefits (2016), people with diabetes are required to take diabetes drugs according to doctor's recommendations as a treatment of their health condition. This is done to prevent worsening of symptoms and avoid various complications that can occur in people with diabetes. If people with diabetes are not obedient in taking medication, blood glucose will accumulate in the blood so that the body cannot use insulin properly. Basically, diabetes drugs only help lower blood sugar levels and reduce the risk of complications. These drugs cannot improve the function of the pancreas in producing insulin or change the way the body works in using insulin.

This is in line with research conducted by Cristiani, (2017) that there is a relationship between medication adherence and neuropathy incidence, when viewed in detail respondents with low medication adherence experience a high incidence of neuropathy. Another study conducted by Adisa et al (2016) that there is a relationship between medication adherence to the incidence of diabetic foot ulcers with a value of p = 0.015 (<0.050).

Drugs used

Based on table 6, the results of the study respondents used metformin more drugs as many as 29 (85.3%) respondents. This is because in combining drugs, there are many considerations made by doctors, apart from clinical sufferers, it is necessary to consider how the drug works. For example, patients with high fasting blood sugar and fat will be given metformin which works to reduce liver sugar production and maximize insulin work in the tissues. While glimepirid is given to patients with low blood sugar levels 2 hours after eating low and thin because glimepirid works by stimulating pancreatic beta cells to produce more insulin. Metformin stimulates glucose uptake, suppresses excess hepatic sugar production, reduces glucose absorption in the intestine, improves insulin resistance, has a high initial response speed, is safe and does not cause weight gain. While glimepirid stimulates Beta cells to release insulin. The high administration of metformin is in accordance with the number of respondents who are more obese because metformin is given to respondents who are obese and have high blood sugar levels (Indra, 2020). In line with Perkeni (2017) which states that metformin is a first-line drug in patients with type 2 diabetes, with the main effect of reducing liver glucose production.

The effect of smoking on the incidence of diabetic foot injuries

Based on table 17 of smoking research results there is no influence on the incidence of diabetic foot injuries, this is based on the number of men obtained only 14 (41.2%) respondents and not all of them smoke, according to the data obtained smoking only 6 (17.6%) respondents and the average smoking >20 cigarettes per day (heavy smokers) has a risk of developing diabetes 62% higher than people who do not smoke. Cigarettes contain nicotine which can cause insulin resistance and reduce the pancreatic response to produce insulin. Diabetes mellitus patients who have a history or habit of smoking are at 10-16 times greater risk of peripheral arterial disease.

The effect of nicotine on insulin includes a decrease in insulin release due to activation of catecholamine hormones, negative influences on insulin work, namely pancreatic beta cell disorders and development towards insulin resistance (Ario, 2017).

This study is in line with research conducted by Wilson (2017) showing that there is no effect of smoking on the incidence of diabetic foot injuries in diabetic patients. The p value of 0.251 is greater than P< 0.05. This study is in line with research conducted by Waaijman, et, al (2013) that smoking factors on the incidence of diabetic foot injuries in diabetic patients. In his research illustrates that smoking risk factors have a p value of 0.178 value which is much greater than P< 0.05.

The effect of obesity on the incidence of diabetic foot injuries

Obese

Based on table 9, the results of the study of respondents who experienced diabetic foot injuries were more experienced by obese respondents as much as 25 (73.5%). This is because belly fat causes fat cells to release pro-inflammatory chemicals that can make the body less sensitive to the insulin it produces by disrupting the function of insulin-responsive cells and their ability to respond to insulin, obesity also triggers changes in the body's metabolism. These changes cause fatty tissue (adipose tissue) to release fat molecules into the blood, which can affect insulin-responsive cells and lead to reduced insulin sensitivity.

Obesity is defined as the accumulation of abnormal or excessive fat that can interfere with health. A person is categorized as obese if the BMI is 30 kg / m2. Obesity is a major component of metabolic syndrome and is significantly associated with insulin resistance (Codario, 2018).

Hal ini sejalan dengan penelitian yang dilakukan oleh Tini (2018) diperoleh hasil bahwa Obese respondents had more diabetic foot ulcers, which was 63.3%. The results of statistical tests found a significant relationship between obesity and the occurrence of diabetic ulcers with a value of p = 0.020 (<0.050). The results of this study are supported by efendi (2014). In diabetics, DM who is overweight or obese will cause insulin resistance. If insulin resistance occurs, it will cause atherosclerosis so that there will be impaired blood circulation in the legs resulting in diabetic feet (Tini, 2018).

BB decline over the past 3 months

Based on table 10 research results of respondents who experienced a decrease in body weight as many as 9 (26.5%) respondents, this is because some respondents severely limit themselves in calorie intake for fear of experiencing an increase in blood sugar levels that are getting higher, the body's ability to absorb nutrients so that it is easy to experience fatigue because the body does not get enough energy. While respondents who did not experience a decrease in body weight as much as 25 (73.5%) respondents, this was based on direct observations made by researchers. Respondents who do not experience a decrease in body weight usually experience an increase in appetite so that they do not adjust the amount or portion of food consumed, do not pay attention to the type of food consumed, even though the provision of education has been carried out by health workers, but there are still some respondents who do not carry out as recommended by health workers.

Conclusion

The conclusion in this study based on the results of the study and the results of the chi-square test can be stated that the factors that influence the incidence of diabetic foot injuries are the influence of age, sex, occupation, length of suffering from DM, drugs, obesity, and smoking.

Acknowledgment

A big thank you to all parties involved in this research.

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