Volume 10, Issue 05, May 2024,
Publish Date: 01-05-2024
Doi https://doi.org/10.55640/ijmsdh-10-05-01

International Journal of Medical Science and Dental Health (Open Access)

RISK FACTOR ANALYSIS FOR GANGRENE IN DIABETES MELLITUS PATIENTS AT HAFIDH CLINIC ACEH BESAR DISTRICT IN 2023

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ABSTRACT

Background: Many factors contribute to the increasing prevalence of diabetes mellitus, including gender, age, education, occupation, and the type of area of residence. Based on the data, the number of visits by diabetic patients to the Hafidh Clinic in Aceh Besar Regency in August was 129 individuals. The occurrence of gangrene in diabetic patients at the Hafidh Clinic in Aceh Besar Regency is mostly unknown to patients, making it interesting for further research. Therefore, patients visiting the Hafidh Clinic and the public will understand the most dominant factors contributing to gangrene occurrence. The aim of this research is to determine the risk factor analysis for the occurrence of gangrene in patients with diabetes mellitus at Hafidh Clinic, Aceh Besar District in 2023. The research design used is analytical observational with a cross-sectional approach. The population in this study consists of new patients at Hafidh Clinic, Aceh Besar District, totalling 127 individuals. Results: The research findings indicate that There is no association between age and the risk of gangrene occurrence at Hafidh Clinic, Aceh Besar District. There is an association between gender and the risk of gangrene occurrence at Hafidh Clinic, Aceh Besar District. There is an association between physical activity and the risk of gangrene occurrence at Hafidh Clinic, Aceh Besar District. There is an association between dietary patterns and the risk of gangrene occurrence at Hafidh Clinic, Aceh Besar District. There is an association between knowledge and the risk of gangrene occurrence at Hafidh Clinic, Aceh Besar District. There is an association between obesity and the risk of gangrene occurrence at Hafidh Clinic, Aceh Besar District. There is an association between family role and the risk of gangrene occurrence at Hafidh Clinic, Aceh Besar District. There is an association between psychological factors and the risk of gangrene occurrence at Hafidh Clinic, Aceh Besar District. The dominant factor influencing the risk of gangrene occurrence at Hafidh Clinic, Aceh Besar District is gender.

KEYWORDS: Risk Factor Analysis, Gangrene, Diabetes Mellitus Patients.

INTRODUCTION

Diabetes Mellitus is a disease that results in mortality worldwide. It is a leading cause of blindness, heart disease, and kidney failure. The International Diabetes Federation (IDF) estimates that at least 483

million people aged 20-79 worldwide suffered from diabetes in 2019, equivalent to a prevalence rate of 9.3% of the total population in the same age group. This prevalence is expected to increase with age to 19.9%, or 111.2 million people aged 65-79. The prediction continues to rise to 578 million by 2030 and 700 million by 2045 *(Anita, 2022)*.

Based on IDF's data estimation, diabetes cases in Indonesia ranked 7th highest in the world after China, India, the United States, Pakistan, Brazil, and Mexico, totaling 10.7 million people in 2019 and projected to exceed 21 million people by 2025. The Health Profile of Indonesia in 2012 indicated that Diabetes Mellitus (DM) ranked 6th out of 10 major diseases among outpatient patients in hospitals in Indonesia *(Ministry of Health, 2013)*. Twelve provinces have diabetes prevalence rates above the national prevalence rate of 1.5%, with the highest prevalence in DI Yogyakarta (2.6%) and DKI Jakarta (2.5%), while the lowest prevalence is in Lampung (0.7%) *(Veridiana, 2019)*.

According to the Non-Communicable Disease (NCD) Profile Data from the Aceh Health Department, there were 116,318 people diagnosed with diabetes in 2020, with 8,564 individuals, or 7.4%, residing in Aceh Besar District. Of this number, 65.1%, or 5,579 individuals, received standard treatment at Community Health Centers *(Puskesmas)*. Puskesmas Kuta Malaka served 1,161 diabetic patients, accounting for 13.4% of the total diabetic patients who visited the 28 Puskesmas in Aceh Besar.

Many factors contribute to the increasing prevalence of diabetes mellitus, including gender, age, education, occupation, and the type of residential area. The prevalence of diabetes mellitus based on doctor diagnoses and symptoms increases with age, but tends to decline after the age of > 75 years. In terms of gender, prevalence is generally higher in females than in males. Prevalence also tends to be higher among urban populations compared to rural areas. This pattern also applies to educational strata *(Riskesdas Aceh, 2018)*.

Wounds that occur in diabetes mellitus are wounds that are linked to abnormalities in the peripheral nerves, where blood vessels experience disturbances. Therefore, suboptimal wound healing processes can result in infections. The majority of wounds that occur in diabetes mellitus over a long period are often caused by tissue death, where blood containing oxygen cannot flow well to the peripheral ends. If this persists for a prolonged period, it will result in tissue death, leading to gangrene. The healing process in diabetic wounds is a complex unit where several factors play an important role in the wound healing process (inflammation, proliferation, and wound closure) *(Mikhayandi John Lede, Tanto Hariyanto, 2018)*.

In the wound healing process, one often overlooked factor is the importance of fulfilling nutritional needs, which can influence the healing process. According to Medical Nutrition Therapy, attention to the principles of dietary regulation is crucial, including the importance of regular meal schedules, types and quantities of food, as well as calorie content, while still considering the use of insulin therapy *(Silaban, Lestari, Daryeti, & Merdekawati, 2019)*.

Diabetes Mellitus (DM) is a chronic disease that lasts a lifetime, and its treatment involves preparing the client and their family to be able to perform self-care actions at home to help control the client's blood sugar levels and prevent complications. This is expected to achieve optimal quality of life and family well-being. The management of DM consists of 5 pillars: education, dietary regulation, exercise,

anti-diabetic medication consumption, and monitoring. The prevention and management of DM complications are the goals of DM management. Effective DM management requires sustained glycemic control over many years to reduce the risk of macrovascular and microvascular complications in individuals with DM. Common complications include the development of ulcers, gangrene, and slow wound healing due to poor blood circulation in the extremities. Diet planning, maintaining a healthy diet, exercise, glucose monitoring, and foot care are forms of care that can be performed and supported by the client's family with DM *(PERKENI, 2015)*.

In efforts to prevent the occurrence of gangrene wounds, there are several factors that must be undertaken for diabetic patients with gangrene wounds. Firstly, in terms of health promotion, nurses play a role in teaching families how to properly care for wounds. Preventive efforts involve providing health education on managing health care within the families of diabetic patients with diabetic foot ulcers, enabling them to understand how to care for family members affected by diabetic complications and how to prevent them. In terms of curative efforts, nurses collaborate with healthcare providers to administer appropriate treatment and provide information on managing healthcare to clients and families. As for rehabilitative efforts, nurses can introduce family members to ways of caring for clients with diabetic foot ulcers at home, and provide education on the importance of proper care for diabetic foot ulcers and managing healthcare within the family *(Gita, 2020)*.

The most important aspect of nursing care for patients with diabetes mellitus and tissue damage is both non-pharmacological and pharmacological interventions. Non-pharmacological interventions involve the role of the family, including educating the patient about foot care, providing nutritional counseling, managing weight, skin care, nail care, wound care on the feet, and using protective footwear. This also includes washing feet, antibiotic therapy, and selecting appropriate dressings, as well as addressing emotional, financial, and spiritual needs.

In Aceh in 2021, there were 184,527 diabetes mellitus patients, with 97,131 or 53% receiving standard care *(Aceh Health Profile, 2021)*. Based on patient visit data for diabetes mellitus at Hafidh Clinic in Aceh Besar District in August, there were 129 visits. The occurrence of gangrene wounds in diabetic patients at Hafidh Clinic in Aceh Besar District is mostly unknown to patients, making it interesting to conduct research. This would help patients visiting Hafidh Clinic and the community understand the most dominant factors leading to gangrene wounds.

From the discussion above, it's crucial to ensure proper wound care for gangrene to prevent infection and avoid amputation. Therefore, this research is conducted to address the issue of " Risk Factor Analysis for Gangrene In Diabetes Mellitus Patients At Hafidh Clinic, Aceh Besar District In 2023."

METHOD

This research is classified as a quantitative study. The research design used is analytical observational with a cross-sectional approach. Observation or measurement of variables is conducted at a single point in time. Each subject to be studied is observed only once, and the measurement of subject variables is carried out during that examination.

The population in this study consists of new patients at Hafidh Clinic, Aceh Besar District, totaling 127 individuals. The sample in this study consists of patients with diabetes mellitus and gangrene wounds. The sampling technique used in this study is total sampling, where the entire population becomes the sample. Data collection for this research was conducted over a period of 3 weeks.

Research ethics include obtaining research consent and ethical approval. This study has obtained Ethical Approval from the Research Ethics Committee of the Faculty of Medicine Syiah Kuala University.

RESULTS

The independent and dependent variables were analyzed descriptively using frequency distribution statistics. In this univariate analysis, the following factors were examined: gangrene risk, age, gender, physical activity, dietary patterns, knowledge, obesity, family role, and psychological factors. The descriptive analysis for the above factors is presented in the table below:

Table 1 (Frequency Distribution of Risk Factors for the Occurrence of Gangrene Wounds in Patients with Diabetes Mellitus at Hafidh Clinic Aceh Besar District 2023.)

Variable	F	Percentage
Gangrene Risk		
At Risk	49	38.6
Not At Risk	78	61.4
Age		
Not productive	118	92.9
Productive	9	7.1
Gender		
Female	46	36.2
Male	81	63.8
Physical Activity		
Irregular	46	36.2
Reguler	81	63.8
Dietary Patterns		
Poor	65	51.2
Good	62	48.8
Knowledge		
Poor	57	44.9
Good	70	55.1
Obesity		
Obese	90	70.9
Not obese	37	29.1
Family Role		
Poor	72	56.7
Good	55	43.3
Psychological		
Poor	73	57.5
Good	54	42.5
Total	**127**	**100.0**

Source: *Primary data processed in 2023.*

Based on Table 1, it is known that respondents at risk of gangrene are 49 individuals (38.6%) and respondents not at risk of gangrene are 78 individuals (61.4%). The number of non-productive respondents is 118 individuals (92.9%) and productive respondents are 9 individuals (7.1%). Male respondents in this study are 46 individuals (36.2%) and female respondents are 81 individuals (63.8%). Respondents who engage in irregular physical activity are 46 individuals (36.2%) and those who regularly engage in physical activity are 81 individuals (63.8%). Respondents with poor dietary patterns are 65 individuals (51.2%) and those with good dietary patterns are 62 individuals (48.8%). Those with poor knowledge are 57 individuals (44.9%) and those with good knowledge are 70 individuals (55.1%). Respondents with obesity are 90 individuals (70.9%) and those without obesity are 37 individuals (29.1%). As for family role, 72 respondents (56.7%) have poor family roles and 55 respondents (43.3%) have good family roles.

The results of the study on the relationship between age and the risk of gangrene occurrence can be seen in the table below:

Table 2 *(Relationship between Age and the Incidence of Gangrene Wounds.)*

Age	Gangrene Risk				Total	OR	95%CI	*P-Value*
	At Risk		Not at Risk					
	f	%	f	%				
Not productive	46 (39.0)		72 (61.0)		118 (100.0)	1,278	(0,304-5,363)	1.000
Productive	3 (33.3)		6 (66.7)		9 (100.0)			
Total	49 (38.6)		78 (61.4)		127 (100.0)			

Source: *Primary data processed in 2023*

From the analysis of 127 respondents, it was found that 46 (39.0%) were non-productive in terms of age, and 72 (61.0%) of them were not at risk of gangrene. Meanwhile, among the productive age group, 3 respondents (33.3%) were at risk of gangrene, and 6 respondents (66.7%) were not at risk of gangrene.

Based on the statistical test results, the p-value obtained was 1.000 > 0.05, indicating that there is no significant relationship between age and the risk of gangrene in patients with diabetes mellitus at Hafidh Clinic, Aceh Besar District in 2023. The odds ratio (OR) value of 1.278 means that non-productive respondents are 1.278 times more likely to experience gangrene risk compared to productive age respondents.

The results of the study on the relationship between gender and the occurrence of gangrene risk can be seen in the following table:

Table 3 *(Relationship between Gender and Gangrene Risk.)*

Gender	Gangrene Risk				Total	OR	95%CI	*P-Value*
	At Risk		Not at Risk					
	f	%	f	%				
Male	31 (67.4)		15 (32.6)		46 (100.0)	7,233	(3,221-16,243)	0.000
Female	18 (22.2)		63 (77.8)		81 (100.0)			
Total	49 (38.6		78 (61.4)		127 (100.0)			

Source: *Primary data processed in 2023.*

From the analysis of 127 samples, it was found that among males, 31 respondents (67.4%) were at risk of gangrene, while 15 respondents (32.6%) were not at risk. On the other hand, among females, 18 respondents (22.2%) were at risk of gangrene, while 63 (77.8%) were not at risk.

Based on the statistical test results, the p-value obtained was 0.000 < 0.05, indicating that there is a significant relationship between gender and the risk of gangrene in patients with diabetes mellitus at Hafidh Clinic, Aceh Besar District in 2023. The odds ratio (OR) value of 7.233 means that male respondents are 7.233 times more likely to experience gangrene risk compared to female respondents.

The results of the study on the relationship between physical activity and the occurrence of gangrene can be seen in the following table:

Table 4: *(Relationship between Physical Activity and Gangrene Risk.)*

Physical Activity	Gangrene Risk				Total	OR	95%CI	*P-Value*
	At Risk		Not at Risk					
	f	%	f	%				
Irregular	29 (63.0)		17 (37.0)		46 (100.0)	5,203	(2,377-11,387)	0.000
Regular	20 (24.7)		61 (75.3)		81 (100.0)			
Total	49 (38.6)		78 (61.4)		127 (100.0)			

Source: *Primary data processed in 2023.*

From the analysis of 127 samples, it is known that respondents who engage in irregular physical activity are at risk of gangrene, with 29 respondents (63.0%) at risk and 17 respondents (37.0%) not at risk. Meanwhile, among respondents who engage in regular physical activity, 20 respondents (24.7%) are at risk of gangrene, while 61 (75.3%) are not at risk.

Based on the statistical test results, the p-value obtained was 0.000 < 0.05, indicating that there is a significant relationship between physical activity and the risk of gangrene in patients with diabetes mellitus at Hafidh Clinic, Aceh Besar District in 2023. The odds ratio (OR) value of 5.203 means that respondents who engage in irregular physical activity are 5.203 times more likely to experience gangrene risk compared to those who engage in regular physical activity.

The results of the study on the relationship between dietary patterns and the occurrence of gangrene can be seen in the following table:

Table 5: *(Relationship between Dietary Patterns and Gangrene Occurrence.)*

Dietary Patterns	Gangrene Risk				Total	OR	95%CI	*P-Value*
	At Risk		Not At Risk					
	f	%	f	%				
Poor	37 (56.9)		28 (43.1)		65 (100.0)	5,506	(2,477-12.238)	0.000
Good	12 (19.4)		50 (80.6)		62 (100.0)			
Total	49 (38.6)		78 (61.4)		127 (100.0)			

Source: *Primary data processed in 2023*

From the analysis of 127 samples, it is known that respondents with poor dietary patterns are at risk of gangrene, with 37 respondents (56.9%) at risk and 28 respondents (43.1%) not at risk. Meanwhile, among respondents with good dietary patterns, 12 respondents (19.4%) are at risk of gangrene, while 50 (80.6%) are not at risk.

Based on the statistical test results, the p-value obtained was 0.000 < 0.05, indicating that there is a significant relationship between dietary patterns and the risk of gangrene in patients with diabetes mellitus at Hafidh Clinic, Aceh Besar District in 2023. The odds ratio (OR) value of 5.506 means that respondents with poor dietary patterns are 5.506 times more likely to experience gangrene risk compared to those with good dietary patterns.

The results of the study on the relationship between knowledge and the occurrence of gangrene can be seen in the following table:

Table 6: *(Relationship between Knowledge and Gangrene Risk.)*

Knowledge	Gangrene Risk				Total	OR	95%CI	*P-Value*
	At Risk		Not At Risk					
	f	%	f	%				
Poor	30 (52.6)		27 (47.4)		57 (100.0)	2,982	(1,423-6.252)	0.006
Good	19 (27.1)		51 (72.9)		70 (100.0)			
Total	49 (38.6)		78 (61.4)		127 (100.0)			

Source: *Primary data processed in 2023.*

From the analysis of 127 samples, it is known that respondents with poor knowledge are at risk of gangrene, with 30 respondents (52.6%) at risk and 27 respondents (47.4%) not at risk. Meanwhile, among respondents with good knowledge, 19 respondents (27.1%) are at risk of gangrene, while 51 (72.9%) are not at risk.

Based on the statistical test results, the p-value obtained was 0.006 < 0.05, indicating that there is a significant relationship between knowledge and the risk of gangrene in patients with diabetes mellitus at Hafidh Clinic, Aceh Besar District in 2023. The odds ratio (OR) value of 2.982 means that respondents with poor knowledge are 2.982 times more likely to experience gangrene risk compared to those with good knowledge.

The results of the study on the relationship between obesity and the occurrence of gangrene can be seen in the following table:

Table 7: *(Relationship between Obesity and Gangrene Occurrence.)*

Obesity	Gangrene Risk				Total	OR	95%CI	*P-Value*
	At Risk		Not At Risk					
	f	%	f	%				
Obese	41 (45.6)		49 (54.4)		90 (100.0)	3.033	(1.251-7.356)	0.021
Not Obese	8 (21.6)		29 (78.4)		37 (100.0)			
Total	49 (38.6)		78 (61.4)		127 (100.0)			

Source: *(Primary data processed in 2023.)*

From the analysis of data from 127 respondents, it is found that obese respondents are at risk of gangrene, with 41 respondents (45.6%) at risk and 49 respondents (54.4%) not at risk. Meanwhile, among non-obese respondents, 8 respondents (21.6%) are at risk of gangrene, while 29 (78.4%) are not at risk.

Based on the statistical test results, the p-value obtained was 0.021 < 0.05, indicating that there is a significant relationship between obesity and the risk of gangrene in patients with diabetes mellitus at Hafidh Clinic, Aceh Besar District in 2023. The odds ratio (OR) value of 3.033 means that obese respondents are 3.033 times more likely to experience gangrene risk compared to non-obese respondents.

The results of the study on the relationship between family role and the occurrence of gangrene can be seen in the following table:

Table 8: *(Relationship between Family Role and Gangrene Risk.)*

Family Role	Gangrene Risk				Total	OR	95%CI	*P-Value*
	At Risk		Not At Risk					
	f	%	f	%				
Poor	35 (48.6)		37 (51.4)		72 (100.0)	2.770 (1.292-5.939)		0.013
Good	14 (25.5)		41 (74.5)		55 (100.0)			
Total	49 (38.6)		78 (61.4)		127 (100.0)			

Source: *Primary data processed in 2023.*

From the analysis of data from 127 respondents, it is found that respondents with a less favorable family role are at risk of gangrene, with 35 respondents (48.6%) at risk and 37 respondents (51.4%) not at risk. Meanwhile, respondents with a good family role who are at risk of gangrene are 14 respondents (25.5%) and those not at risk are 41 (74.5%).

Based on statistical analysis, a p-Value of 0.013 < 0.05 indicates a relationship between family role and gangrene risk in patients with diabetes mellitus at Klinik Hafidh, Kabupaten Aceh Besar in 2023. The OR value of 2.770 means that respondents with a less favorable family role have a 2.770 times higher risk of experiencing gangrene compared to those with a good family role.

The results of the study on the relationship between psychological factors and the incidence of gangrene can be seen in the following table:

Table 9. *(Relationship between Psychological Factors and Gangrene Incidence.)*

Psychologica	Gangrene Risk		Total	OR	95%CI	*P-Value*
	At Risk	Not at				

	Risk						
	f	%	f	%			
Poor	34 (46.6)		39 (53.4)		73 (100.0)	2.267 (1.068-4.810)	0.049
Good	15 (27.8)		39 (72.2)		54 (100.0)		
Total	49 (38.6)		78 (61.4)		127 (100.0)		

Source: *Primary data processed in 2023.*

From the analysis of data from 127 respondents, it is found that respondents with poor psychological conditions are at risk of developing gangrene, with 34 respondents (46.6%) at risk and 39 respondents (53.4%) not at risk. Meanwhile, respondents with good psychological conditions who are at risk of developing gangrene are 15 respondents (27.8%) and those not at risk are 39 respondents (72.2%).

Based on the statistical analysis, the p-Value obtained is 0.049 < 0.05, indicating that there is a relationship between psychological factors and the risk of gangrene in patients with diabetes mellitus at the Hafidh Clinic in Aceh Besar District in 2023. The OR value is 2.267, meaning that respondents with poor psychological conditions are 2.267 times more likely to experience gangrene risk compared to respondents with good psychological conditions.

The multivariate analysis used in this study is logistic regression. Data from the dependent variable are dichotomous (binary), which is gangrene or not, so the testing is conducted using logistic regression. If the bivariate results yield a p-Value < 0.25, then the variable is selected for further multivariate testing.

Table 10 *(Bivariate Selection Results.)*

Variable	P-Value
Age	1.000
Gender	0.000
Physical activity	0.000
Dietary pattern	0.000
Knowladge	0.006
Obesity	0.021
Family role	0.013
Psychologica	0.049

Source: Primary data processed in 2023.

Based on the bivariate selection results in Table 4.12 above, the p-Value of the age variable is > 0.25, so it is not included in the logistic regression test. Therefore, the variables of gender, physical activity, dietary pattern, knowledge, obesity, family role, and psychological factors meet the criteria for further logistic regression analysis to assess their contribution to the risk of gangrene in patients with diabetes mellitus at Klinik Hafidh, Kabupaten Aceh Besar, in 2023.

The results of the logistic regression analysis of the independent variables gender, physical activity, dietary pattern, knowledge, obesity, family role, and psychological factors on the dependent variable, the occurrence of gangrene risk, can be seen in the following table:

Table 11 *(Logistic Regression Test Results for Gender, Physical Activity, Dietary Pattern, Knowledge, Obesity, Family Role, and Psychological Factors with the Occurrence of Gangrene Risk.)*

Variable	Value B	Wald	P-Value	OR	95% Cl	
					Lower	Upper
Gender	3.629	22.970	0.000	37.678	8.542	166.196
Physical activity	2.765	15.341	0.000	15.879	3.980	63.347
Dietary pattern	2.133	9.834	0.002	8.440	2.225	32.031
Knowladge	0.396	0.394	0.530	1.486	0.432	5.112
Obesity	1.389	3.716	0.054	4.011	0.977	16.466
Family role	1.729	2.601	0.009	5.635	1.541	20.613
Psychologica	1.038	2.601	0.107	2.817	0.800	9.920

Source: Primary data processed in 2023.

From the logistic regression analysis results, it is evident that the variables of knowledge, obesity, and psychological factors have p-values > 0.05, indicating that the largest p-value, which is knowledge, is excluded from further modeling.

Table 12 *(Logistic Regression Test Results for Gender, Physical Activity, Diet, Obesity, Family Role, and Psychological Factors with the Incidence of Gangrene Risk.)*

Variable	Value B	Wald	P-Value	OR	95% Cl	
					Lower	Upper
Gender	3.608	23.134	0.000	36.894	8.481	160.503
Physical activity	2.823	16.541	0.000	16.836	4.318	65.640
Dietary pattern	2.259	11.895	0.001	9.572	2.652	34.553
Obesity	1.401	3.875	0.049	4.059	1.006	16.376
Family role	1.737	6.965	0.008	5.678	1.564	20.622
Psychologica	1.132	3.234	0.072	3.101	0.903	10.646

Source: *Primary data processed in 2023.*

The logistic regression analysis results indicate that there is a significant influence of gender (p = 0.000), physical activity (p = 0.000), diet (p = 0.001), obesity (p = 0.049), and family role (p = 0.008) on the incidence of gangrene risk. The most dominant factor affecting gangrene risk is gender, with an OR value of 36.894, meaning that male patients with diabetes mellitus are at 36.894 times higher risk of developing gangrene compared to female patients.

DISCUSSION

1. **Relationship between Age and Gangrene Risk**

Based on the research results, it is known that there were 46 respondents (39.0%) in the non-productive age group, with 72 respondents (61.0%) not at risk of gangrene within this group. Meanwhile, among respondents in the productive age group, 3 respondents (33.3%) were at risk of gangrene, while 6 respondents (66.7%) were not at risk. Based on the statistical test results, a p-Value of 1.000 > 0.05 was obtained, indicating that there is no relationship between age and the risk of gangrene in patients with diabetes mellitus at the Hafidh Clinic in Aceh Besar District in 2023. The OR value of 1.278 means that respondents in the non-productive age group have a 1.278 times higher risk of gangrene compared to those in the productive age group.

The research findings are in line with a study conducted at RSUD Dr. Soedarso Pontianak, which found no significant relationship between age and the occurrence of diabetic gangrene in patients with diabetes mellitus (p=0.772). In that study, it was observed that the age distribution of respondents in both case and control groups was nearly balanced, with most respondents being over 50 years old. It is possible that respondents who developed diabetic gangrene had been diagnosed with diabetes mellitus for a long time and experienced diabetic gangrene several years after the diabetes mellitus diagnosis. The disease may have been exacerbated as respondents aged due to declining organ function, particularly pancreatic dysfunction in insulin production.

Mutia's study (2020) found a significant association between age and the occurrence of diabetic foot ulcers, but poor blood sugar control could increase the likelihood of diabetic foot ulcers. Several studies on populations worldwide have shown an increase in the prevalence of type 2 diabetes mellitus with advancing age, followed by a decline in very old age. The prevalence of diabetes mellitus peaks at ages 70-89 and 60-69, then decreases in those over 70 years old. The decrease in diabetes mellitus prevalence in very old age indicates that those in the very old age group have lower survival strength compared to previous age groups. This is related to chronic complications of diabetes mellitus, which lead to increased morbidity and mortality in very old age, also related to the duration of diabetes mellitus. Those who develop diabetes mellitus at an older age have higher survival strength than those who have had diabetes mellitus for years. Age is also an important factor associated with the development of peripheral vascular disease, neuropathy, and lower extremity amputation.

The researcher's assumption is that although age may be an additional risk factor for diabetes and its complications, the relationship between age and gangrene is more complex and influenced by several other factors. Therefore, it is important to consider several different variables when evaluating the risk of gangrene in patients with diabetes.

2. The Relationship between Gender and the Risk of Gangrene

Based on the research results, it is known that males who are at risk of gangrene occurrence amounted to 31 respondents (67.4%), while those not at risk amounted to 15 respondents (32.6%). Meanwhile, females who are at risk of gangrene occurrence numbered 18 respondents (22.2%), and those not at risk amounted to 63 (77.8%). From the statistical test results, a p-Value of 0.000 < 0.05 was obtained, indicating a relationship between gender and the risk of gangrene in patients with diabetes mellitus at Hafidh Clinic, Kabupaten Aceh Besar, in 2023. An OR value of 7.233 means that male respondents have a 7.233 times higher risk of experiencing gangrene compared to female respondents.

An interesting finding in this study is that the majority of respondents with diabetic gangrene were male. Based on interviews, it was found that male respondents did not practice good foot care such as washing their feet daily, using foot moisturizers, and not doing diabetic foot exercises, leading to a higher risk of gangrene in males.

According to the researcher's assumptions in this study, both male and female respondents have an equal chance of experiencing gangrene complications. However, females have hormones that can maintain balance and normalize blood sugar levels, thus preventing chronic complications in patients with diabetes mellitus. On the other hand, male patients have poorer foot care compared to female patients, leading to a higher incidence of diabetic gangrene cases in male patients with diabetes mellitus.

3. The Relationship Between Physical Activity and Gangrene Risk

Based on the research findings, it is known that respondents who engage in physical activity irregularly are at risk of gangrene, with 29 respondents (63.0%) being at risk and 17 respondents (37.0%) not being at risk. Meanwhile, respondents who regularly engage in physical activity have 20 respondents (24.7%) at risk and 61 respondents (75.3%) not at risk of gangrene. The statistical test results yielded a p-value of 0.000, indicating a significant association between physical activity and gangrene risk among diabetes mellitus patients at the Hafidh Clinic in Aceh Besar Regency in 2023. The odds ratio (OR) of 5.203 suggests that respondents who do not engage in physical activity regularly are 5.203 times more likely to experience gangrene compared to those who do.

This finding is consistent with the study conducted by Nurayati & Adriani (2017), which stated that there is a relationship between physical activity and diabetic neuropathy complications. Physical activity can lower fasting blood sugar levels and prevent complications. Muscles in the body will react with stored glucose, reducing glucose storage in the body. Blood glucose levels will decrease, allowing blood sugar in the body to be controlled.

According to the researchers' assumptions, physical activity plays a crucial role in overall health, and in individuals with diabetes mellitus (DM), physical activity can affect the risk of developing gangrene. Physical activity in diabetes patients should be tailored to their health condition, and consulting with healthcare professionals before starting a new exercise program is highly recommended. Physical activity that is too intense or not suitable for the physical condition of diabetes patients can increase the risk of injury and complications.

Based on the researchers' analysis, there is a relationship between physical activity and the occurrence of DM, mostly due to physical activities that involve spending more time watching TV and lying down. Activities like these are classified as light physical activities, meaning that energy expenditure in the body is not significant, while energy intake from food continues to increase, leading to an imbalance between energy intake and energy needs, and energy consumption is a risk factor for the occurrence of DM.

4. The Relationship Between Dietary Patterns and Gangrene Risk

Based on the research results, it is known that respondents with unhealthy dietary habits are at risk of gangrene, with 37 respondents (56.9%) at risk and 28 respondents (43.1%) not at risk. Meanwhile, respondents with good dietary habits have 12 respondents (19.4%) at risk and 50 respondents (80.6%) not at risk of gangrene. The statistical test results yielded a p-Value of 0.000 < 0.05, indicating a significant relationship between dietary habits and the risk of gangrene in patients with diabetes mellitus at the Hafidh Clinic in Aceh Besar Regency in 2023. The OR value of 5.506 means that respondents with poor dietary habits are at 5.506 times higher risk of gangrene compared to those with good dietary habits.

These research findings align with a study by Verawati (2014) titled "Dietary Patterns Associated with Blood Sugar Levels in DM Patients," which found a correlation between dietary patterns and blood sugar levels in DM patients at the Inpatient Installation of PKU Muhammadyah Hospital in Semarang, with a p-value of 0.001. Patients with irregular dietary patterns had worse blood sugar levels compared to those with regular dietary patterns. Similarly, the study by Tukloy (2014) titled "The Relationship between Dietary Patterns and Physical Activity with the Incidence of DM" at RSUD Karel Sadsuitubun in Langgur, Southeast Maluku, found a significant association between dietary patterns and the incidence of DM, with a p-value of 0.001 (Dafriani, 2017).

According to the researcher's assumption, the relationship between dietary patterns and the incidence of DM is attributed to the high consumption of carbohydrates, fats, and sugar. High carbohydrate intake can elevate blood glucose levels. High fat content can make cells in the body less sensitive to insulin. As a result, blood glucose levels rise above normal because body cells cannot use insulin optimally, leading to DM.

5. The Relationship Between Knowledge and Gangrene Risk

Based on the research findings, it is known that respondents with a poor level of knowledge are at risk of gangrene, with 30 respondents (52.6%) being at risk and 27 respondents (47.4%) not at risk. Meanwhile, respondents with good knowledge are at risk of gangrene, with 19 respondents (27.1%) being at risk and 51 respondents (72.9%) not at risk. From the statistical test results, a p-value of 0.006 < 0.05 indicates a relationship between knowledge and the risk of gangrene in patients with diabetes mellitus at the Hafidh Clinic in Aceh Besar Regency in 2023. An odds ratio (OR) of 2.982 means that respondents with poor knowledge have a 2.982 times higher risk of gangrene compared to respondents with good knowledge.

According to the research by Oktorina, 62.9% of respondents had low knowledge, 88.6% had never had ulcers, and 51.4% had low socioeconomic status [9]. The bivariate analysis results showed a relationship between knowledge (p = 0.038, OR = 6) and socioeconomic status (p = 0.028, OR = 6.417) with preventive behavior for diabetic ulcer complications, while the ulcer experience variable was not associated with preventive behavior for diabetic ulcer complications (p = 0.619). The research by Arifin indicated a significant relationship between the knowledge of type II diabetes mellitus patients and foot care practices in preventing wounds (p = 0.020) (Arifin, 2021).

According to the researcher's assumption, the level of knowledge of the respondents is one of the factors related to preventive behavior for gangrene wounds in patients with diabetes mellitus who are

striving for recovery. This is something that needs to be considered for diabetes mellitus patients who are given support by healthcare professionals for gangrene prevention. It can motivate them to undergo treatment more enthusiastically and reduce their illness. Additionally, patients should regularly take their medication and follow up with check-ups at health centers or clinics for gangrene treatment.

6. The Relationship Between Obesity and Gangrene Risk

Based on the research results, it is found that obese respondents are at risk of developing gangrene, with 41 respondents (45.6%) at risk and 49 respondents (54.4%) not at risk. Meanwhile, non-obese respondents who are at risk of gangrene are 8 respondents (21.6%), and those not at risk are 29 (78.4%). Based on statistical analysis, the p-value obtained is 0.021 < 0.05, indicating a relationship between obesity and the risk of gangrene in patients with diabetes mellitus at the Hafidh Clinic in Aceh Besar District in 2023. The OR value of 3.033 means that obese respondents are 3.033 times more likely to experience the risk of gangrene compared to non-obese respondents.

This is consistent with research conducted at Anutapura Hospital in Palu, which found a relationship between BMI status and obesity with the incidence of diabetic ulcers (p=0.027) (Sandra, 2016). This is also in line with the findings of Musyafirah (2016), stating that obesity is a factor associated with the risk of gangrene. This study is consistent with previous research (Yuliani, 2015) which showed a significant relationship between BMI/obesity and the incidence of coronary heart disease. Yuliani explained in her research that theoretically, obesity can increase the risk of cardiovascular disease due to its association with metabolic syndrome consisting of insulin resistance, dyslipidemia, diabetes mellitus, fibrinolysis disorders, hypertension, hyperuricemia, and hyperfibrinogenemia. Ultimately, this will lead to diabetic neuropathy with terminal foot wounds or diabetic ulcers.

According to the researcher's assumption, obesity can be a factor leading to diabetes mellitus (DM). Accumulation of fat due to being overweight or obesity condition can cause insulin resistance, resulting in insulin being unable to work optimally and blood sugar levels rise. Being overweight also facilitates the onset of hypertension and increased blood lipids. This will have an impact on kidney disorders, heart disease, and stroke. Overweight individuals with diabetes are more prone to complications.

7. The Relationship Between Family Role and Gangrene Risk

Based on the research findings, it is known that respondents with poor family roles are at risk of developing gangrene, with 35 respondents (48.6%) being at risk and 37 respondents (51.4%) not at risk. Meanwhile, respondents with good family roles who are at risk of gangrene are 14 respondents (25.5%), and those not at risk are 41 (74.5%). The statistical test results yielded a p-Value of 0.013 < 0.05, indicating a relationship between family roles and gangrene risk in patients with diabetes mellitus at the Hafidh Clinic in Aceh Besar District in 2023. The OR value of 2.770 means that respondents with poor family roles are 2.770 times more likely to experience gangrene risk compared to those with good family roles.

This research aligns with a study conducted by Dinar Izzati Silvia in 2018, which obtained data from 23 questions assessing the success rate of a diet program categorized as unsuccessful, less successful, fairly successful, and successful. The statistical test using Spearman rank with a p-value > α, namely 0.01 >

0.05, indicates a relationship between the implementation of family roles and the success rate of a diet program in type 2 diabetes mellitus patients in the Kaliwates Community Health Center area in Jember Regency (Hariyadi, 2022).

Family support is one of the essential factors in motivating Diabetes Mellitus patients to improve their quality of life through social and emotional support from their family or partner. Consistent with Morge et al. (2020), inadequate family support and busy work schedules are barriers related to self-management of Diabetes in patients with Gangrene wounds, thus hindering adequate wound care or self-wound care. Marriage to a supportive partner can enhance patient implementation quality and increase the percentage of patients recovering from Gangrene wounds (Laili, 2024).

According to the researcher's assumption in this study, family role is crucial in implementing the diet for DM clients, especially in meal preparation and provision. Family role and support influence clients' eating patterns, especially in implementing a DM diet. In meal planning or diet implementation, clients cannot do it alone because patients are social beings who need assistance and support from their loved ones. Family support and role play a significant role in helping DM patients undergo a series of treatments for DM. Their closest ones are their family, but sometimes they have other commitments, so they cannot perform optimally.

8. The Relationship Between Psychological Factors and Gangrene Risk

Based on the research results, it is known that respondents with poor psychological condition are at risk of gangrene occurrence, with 34 respondents (46.6%) being at risk and 39 respondents (53.4%) not at risk. Meanwhile, respondents with good psychological condition who are at risk of gangrene are 15 respondents (27.8%), and those not at risk are 39 (72.2%). The statistical test yielded a p-value of 0.049 < 0.05, indicating a relationship between psychological condition and gangrene risk in patients with diabetes mellitus at the Hafidh Clinic, Aceh Besar District in 2023. The odds ratio (OR) of 2.267 means that respondents with poor psychological condition have a 2.267 times higher risk of experiencing gangrene compared to those with good psychological condition.

Consistent with research conducted by Laili, N., & Adistya, N. (2022), Self Wound Care, as part of wound care, is believed to contribute positively to improving individuals' knowledge, attitudes, and awareness of wounds and wound care. Patients play a crucial role and have a central role in the process of care and healing of diseases, including wounds. Self-wound care by individuals as an action to prevent infection and further complications, if not done correctly, will result in a decrease in activity capability, productivity, and poor psychological condition due to the length of care and healing process (Laili, 2024).

Diabetic patients who are less motivated or experience motivational issues tend to be less compliant with treatment plans, including neglecting foot care, which is crucial for preventing wounds and gangrene. Diabetic patients are at higher risk of experiencing depression or anxiety, which can affect adherence to diabetes management plans, including blood sugar monitoring, diet, and exercise. Uncontrolled psychological conditions can increase the risk of complications, including gangrene. Psychological factors such as the level of social support can also affect the well-being of diabetic

patients. Good social support can help alleviate stress, increase motivation, and improve adherence to treatment (Rohmin, 2018).

According to the researcher's assumption, psychological factors can be complex and interrelated. Psychological therapy or counseling can help diabetic patients cope with stress, depression, or anxiety that may affect their overall health. As part of diabetes management, it is important to pay attention to the psychological aspects of patients, provide necessary support, and ensure that proposed treatment plans can be integrated into their daily lives. Holistic efforts involving both physical and psychological care can help reduce the risk of gangrene and other complications in diabetic patients.

CONCLUSION

Conclusion from this research are as follows:

1. There is no association between age and the risk of gangrene occurrence at Hafidh Clinic, Aceh Besar District.
2. There is an association between gender and the risk of gangrene occurrence at Hafidh Clinic, Aceh Besar District.
3. There is an association between physical activity and the risk of gangrene occurrence at Hafidh Clinic, Aceh Besar District.
4. There is an association between dietary patterns and the risk of gangrene occurrence at Hafidh Clinic, Aceh Besar District.
5. There is an association between knowledge and the risk of gangrene occurrence at Hafidh Clinic, Aceh Besar District.
6. There is an association between obesity and the risk of gangrene occurrence at Hafidh Clinic, Aceh Besar District.
7. There is an association between family role and the risk of gangrene occurrence at Hafidh Clinic, Aceh Besar District.
8. There is an association between psychological factors and the risk of gangrene occurrence at Hafidh Clinic, Aceh Besar District.
9. The dominant factor influencing the risk of gangrene occurrence at Hafidh Clinic, Aceh Besar District is gender.

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