THE RELATIONSHIP OF OBESITY TO DIABETIC FOOT ULCER IN TYPE 2 DIABETES MELLITUS PATIENTS

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Abstract:
Diabetes mellitus is a group of metabolic diseases, the common finding of which is elevated blood glucose levels, known as hyperglycemia. Severe hyperglycemia causes classic symptoms such as polyuria, polydipsia, and polyphagia and unexplained weight loss. This study used an observational descriptive analytic method with a cross sectional design to 42 respondents of type 2 Diabetes mellitus patients at PKU Muhammadiyah Gamping Hospital. The blood sugar levels, HbA1C, height, weight and incidence of diabetic foot ulcers were recorded. Data analysis used the Chi-Square test to see the relationship between obesity and the incidence of diabetic foot ulcers in patients with type 2 diabetes mellitus. The results of the study on 42 respondents showed that there were 31 Diabetes mellitus patients with diabetic foot ulcers (73.8%) while 11 people (26.2%). There were 21 male patients (50%) and 21 female patients (50%). A total of study subjects with normal Body Mass Index had type 2 diabetes mellitus with complications of diabetic foot ulcers (77.8%). 13 study subjects with overweight Body Mass Index experienced type 2 diabetes mellitus with complications of diabetic foot ulcers (61.9%). 11 study subjects with Body Mass Index obese class 1 had type 2 diabetes mellitus with complications of diabetic foot ulcers (91.7%). In patients with type 2 diabetes mellitus without complications of diabetic foot ulcers with normal Body Mass Index, there were 2 people (22.8%). In patients with type 2 diabetes mellitus without complications of diabetic foot ulcers with Body Mass Index overweight, there were 8 people (38.1%). Then in patients with type 2 diabetes mellitus without complications of diabetic foot ulcers with Body Mass Index obesity class 1 obtained 1 person (8.3%). The Chi-Square test was performed and the p value = 0.166. There is no significant relationship between obesity and the incidence of diabetic foot ulcers in patients with type 2 diabetes mellitus.

Keywords: Diabetes mellitus; Diabetic foot ulcer; Obesity
Introduction

Diabetes mellitus can occur when there is an increase in glucose levels in a person's blood because the body cannot produce or sufficient insulin or cannot effectively bind insulin to its receptors in various tissues (insulin resistance). Insulin is an important hormone produced in the pancreas. Insulin is a hormone needed to convert sugar, starch, and other foods into energy, causing persistent high blood sugar. Insulin is also important for protein and fat metabolism. The inability of cells to respond, causing high blood glucose levels (hyperglycemia), which is a clinical indicator of diabetes, if left unchecked in the long term, can lead to various complications.

In 2016, there were 1.6 million deaths caused by Diabetes Mellitus, making it the 7th leading cause of death globally. As many as 26.4% of the 261.1 million population in Indonesia in 2016 died from diabetes. In Indonesia, the highest prevalence of diagnosed DM was in the provinces of DKI Jakarta (3.4%), DIY (3.1%), East Kalimantan (3.1%), North Sulawesi (3%) and East Java (2.6%). The prevalence of DM in 2018 increased by 2% compared to 2013. DM poses a major threat to human health as well as a large socio-economic burden for governments. Therefore, DM needs special attention.

There are two factors that cause the high incidence of DM, namely patient factors, which can be controlled and risk factors, which cannot be controlled.

Risk factors that cannot be controlled are race and ethnicity, age, gender, family medical history of diabetes mellitus, history of giving birth to babies weighing more than 4000 grams, and history of low birth weight less than 2500 grams. unhealthy lifestyle, obesity, lack of physical activity, impaired blood glucose levels, and smoking.
neuropathy and/or peripheral arterial disease of the lower limbs in patients with diabetes. The diagnosis of diabetic foot ulcers is based on a history of diabetes mellitus, symptoms of neuropathy or peripheral arterial disease (PAD) and the presence of ulcerations in the feet. It is reported that about 15% of all diabetics will develop a foot ulcer during their lifetime. Diabetic foot ulcers increase morbidity in diabetic patients, leading to an increase in the number of outpatient and emergency room visits and hospitalization days with a greater risk of osteomyelitis and amputation.

There are several risk factors as follows: gender (male), duration of diabetes more than 10 years, advanced age of the patient, high body mass index, and other comorbidities such as retinopathy, diabetic peripheral neuropathy, peripheral vascular disease, glycosylated hemoglobin levels (HbA1c), foot deformity, high plantar pressure, infection, and improper foot care habits. Therefore, special attention to foot care should be the main focus in the management of patients with diabetes to ensure that DFU can be prevented.

DFU treatment is essential to prevent further damage from ulceration. This is because DM patients with diabetic foot ulcers, mostly experience stress, depression and anxiety. They also have financial burdens, feel helpless, blame themselves and feel there is uncertainty in their lives.

Examination of the ulceration based on the depth, edge, shape and size to determine the severity of the ulcer and the treatment that the patient will receive. Obesity itself, as well as hypertriglyceridemia, can directly increase the risk of developing peripheral neuropathy. Subcutaneous tissue thickness in obese individuals is thought to reduce the amplitude of sensory responses when given percutaneous simulation.

The likelihood of neurogenic damage expressed by changes in sensory thresholds is independent of glucose levels but is associated with hyperinsulinemia and insulin sensitivity. Following an increase in the sensory threshold shown in some obese individuals it is thought to be due to specific metabolic changes, potentially leading to peripheral neuropathy and diabetic foot ulcers. Therefore, this study was conducted to determine the relationship between obesity and the incidence of diabetic foot ulcers in patients with type diabetes mellitus 2.

**Research Method**

The research design used in this study was analytic observational with a cross sectional approach. The sample was 42 patients with type 2 diabetes mellitus with or without complications of diabetic foot ulcers based on medical records at PKU Muhammadiyah Gamping Hospital with exclusion criteria for type 2 diabetes mellitus patients with or without complications and inclusion criteria for incomplete medical record data from the required variables.

This study began with the collection of secondary data in the form of medical records of patients with type 2 diabetes mellitus or without complications of diabetic foot ulcers according to the inclusion and exclusion criteria. The data are then categorized by gender, BMI, and the incidence of diabetic foot ulcers. Then statistical tests were carried out using SPSS software with a Chi Square unpaired comparative test and using the Fisher Test if the Chi Square conditions were not met. Data were expressed with 95% confidence interval (p<0.05). This research has submitted an application for ethical clearance to the ethics committee of the Faculty of Medicine and Health Sciences UMY and has been approved with the number 022/EC-EXEM-KEPK FKIK UMY/III/2021.
Results
Respondents’ distribution based on gender resulted 21 male respondents (50%) and 21 female respondents (50%) from the total of 42 respondents. The proportions of the research samples are 50% each and there is no significant difference.

Table 1. Respondents’ distribution based on BMI

<table>
<thead>
<tr>
<th>BMI</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>9</td>
<td>21.4</td>
</tr>
<tr>
<td>Overweight</td>
<td>21</td>
<td>50.0</td>
</tr>
<tr>
<td>Obesity class 1</td>
<td>12</td>
<td>28.6</td>
</tr>
<tr>
<td>Total</td>
<td>42</td>
<td>100</td>
</tr>
</tbody>
</table>

From the research data in Table 1, the highest proportion of type 2 diabetes mellitus patients was overweight, as many as 21 people (50%). Then there were 12 people with class 1 obesity (28.6%) and 9 people with normal BMI (21.4%). BMI calculation is based on height (m) and weight (kg), then the BMI calculation results are classified according to WHO.

From the research data, it was found that there were 31 patients with diabetes mellitus type 2 with diabetic foot ulcer complications (73.8%); while 11 people (26.2%) found without it. In this study, patients were hospitalized and found that the most common complications encountered in the last 3 years were patients with ulcers and patients with kidney failure.

Table 2 The Relationship of Obesity to the Incidence of Diabetic Foot Ulcers

<table>
<thead>
<tr>
<th>BMI</th>
<th>DM with Ulcer Incidence</th>
<th>DM without Ulcer Incidence</th>
<th>Total</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>frequency</td>
<td>frequency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>7 (77.8%)</td>
<td>2 (22.8%)</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Overweight</td>
<td>13 (61.9%)</td>
<td>8 (38.1%)</td>
<td>21</td>
<td>0.166</td>
</tr>
<tr>
<td>Obesity class 1</td>
<td>11 (91.7%)</td>
<td>1 (8.3%)</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>31 (73.1%)</td>
<td>11 (26.9%)</td>
<td>42</td>
<td></td>
</tr>
</tbody>
</table>

From Table 2, it was found that 7 study subjects with normal BMI had type 2 diabetes mellitus with complications of diabetic foot ulcers with a percentage of 77.8%. Then 13 study subjects with overweight BMI experienced type 2 diabetes mellitus with complications of diabetic foot ulcers with a percentage of 61.9%. Then 11 research subjects with BMI obesity class 1 experienced type 2 diabetes mellitus with complications of diabetic foot ulcers with a percentage of 91.7%. In patients with type 2 diabetes mellitus without complications of diabetic foot ulcers with normal BMI, there were 2 people with a percentage of 22.8. Then in patients with type 2 diabetes mellitus without complications of diabetic foot ulcers with overweight BMI, there were 7 people with a percentage of 38.1%.

Then in patients with type 2 diabetes mellitus without complications of diabetic foot ulcers with BMI obesity class 1 obtained 1 person with a percentage of 8.3%. The results of the analysis using the Chi-Square test obtained p value 0.166. Because p value > 0.05, so H0 is accepted, and it can be concluded that there is no relationship between obesity and the incidence of diabetic foot ulcer complications.

Discussion
In this study, it showed that there was no significant relationship between obesity and the incidence of diabetic foot ulcers in patients with type 2 diabetes mellitus. In patients with type 2 diabetes, where in the study it was stated that obesity can affect the severity of diabetic foot ulcers in patients with
type 2 diabetes with risk factors for poor self-care resulting in limited flexibility and inability to care for, or inspect their feet every day.\(^28\)

In this study, obesity did not have a significant relationship with the incidence of diabetic foot ulcers in type 2 diabetes mellitus patients, because there were several other factors that were more influential in causing ulcers than obesity. Neuropathic factors have a strong relationship with foot ulcers in diabetic patients. Diabetic patients who had neuropathy were 21.7 times more likely to develop diabetic foot ulcers compared to diabetic patients without neuropathy. Peripheral neuropathy causes vasomotor paresis resulting in arteriovenous dysfunction of the subcutaneous vascular tissue. In addition, sweat secretion becomes dysfunctional by vasomotor paresis. Non-functioning sweat causes a lack of moisture and cooling through evaporation. As a result, the skin on the feet dries with a consequent reduction in the protective function of the skin and thus increases the risk of injury.\(^29\) On environmental factors, it was found that diabetic patients living in rural areas were 2.57 times more likely to develop diabetic foot ulcers than diabetic patients from urban areas.

Diabetic patients who live in rural areas often spend most of their time in agricultural areas or outdoors and can experience injuries to their feet as a result of animal bites. Wounds on the feet of diabetics can lead to the development of ulcers due to poor wound healing and lack of health care opportunities. Another possible explanation is that diabetic patients living in rural areas have poor awareness of personal hygiene and foot care practices, and they often walk barefoot. This can expose their feet to harm and lead to the development of diabetic foot ulcers.\(^30\)

**Conclusions**

Based on the results of the research and discussion conducted, it can be concluded that there is no significant difference between obesity and the occurrence of diabetic foot ulcers in type 2 diabetes mellitus patients with \( p \) value = 0.166 and OR = 1.313.

In this study, there are still a lot of incomplete medical record data, it is hoped that the medical record officer at PKU Muhammadiyah Gamping Hospital can do a complete record. In addition, this study still uses a small number of samples and only in 1 place, furthermore it may be possible to develop a larger number of samples and from various places in order to achieve maximum results.

**References**


