


The Effect Of Obesity On Diabetic Ulcers In Diabetes Mellitus Patients

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Article Info	ABSTRACT
<p>Keywords: Obesity, Ulcers Diabetic, Diabetes Mellitus</p>	<p>Diabetes mellitus (DM) is disease metabolic characterized with hyperglycemia Because lack of insulin secretion, insulin action, or both of them. Diabetes was diagnosed when blood sugar fasting >126 mg/dL and 2-hour blood sugar >200 mg/dL. Diabetic foot ulcers is one of complications chronic from Diabetes mellitus (DM) disease in the form of surface wound skin of the feet of diabetics accompanied by with damage network part in or death network. Risk factors can influence incident DM ulcers are cigarettes, obesity, increasing work physique especially in men. Method: Review literature review using Google Scholar, National Center for Biotechnology Information (NCBI) & Research Science 20 journals obtained from criteria inclusion & exclusion. Results: Complications ulcer diabetic in patients with diabetes mellitus type 2 is one of the the most cases treated at home sick. There are several modifiable factors, including obesity. Condition obesity can cause insulin resistance which results in atherosclerosis so that happen disturbance circulation blood in the legs that can cause ulcer diabetic. Conclusion: Risk factors can influence incident DM ulcers are obesity, condition obesity can cause insulin resistance which results in atherosclerosis so that happen disturbance circulation blood in the legs that can cause ulcer diabetic.</p>
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INTRODUCTION

Diabetes mellitus (DM) is a metabolic disease characterized by hyperglycemia due to deficiencies in insulin secretion, insulin action, or both. Diabetes is diagnosed when fasting blood sugar is >126 mg / dL and 2-hour blood sugar is >200 mg / dL. The International Diabetes Federation (IDF) reports that 371 million people between the ages of 20 and 79 suffer from DM worldwide. Indonesia is the seventh country with the highest prevalence of DM. According to the IDF, the number of DM cases will increase to 205 million among DM patients aged 40-59 years in 2035. ¹

Diabetes mellitus (DM) is currently one of the global health threats. Based on the cause, DM is divided into four groups, namely type 1 DM, type 2 DM, type 3 DM, and type 4 DM. gestational and type 1 DM others. ² According to The perkeni included complications chronicle

is macroangiopathy, microangiopathy and neuropathy. Neuropathy is system failure nerves in the feet and legs blood peripheral, is door beginning occurrence of diabetic foot. International Diabetes Federation state incident the in a way No direct increase prevalence Diabetic wounds 1-4% in DM patients. ³ It is very important for diabetic patients to obtain optimal glucose control by strictly adhering to medication therapy, diet and exercise to reduce long-term complications associated with non-compliance with treatment recommendations.⁴

Diabetic foot ulcer is one of complications chronic from Diabetes mellitus (DM) disease in the form of surface wound skin of the feet of diabetics accompanied by with damage network part in or death network, good with or without infection, so that can cause amputation of the lower 2nd extremity associated with with existence neuropathy or disease artery peripheral in patients with diabetes mellitus. ⁵

Risk factors can affect the incidence of DM ulcers, namely smoking, obesity, increased physical work, especially in men. The duration of suffering from DM will also increase the risk of recurrent ulcers. This will certainly reduce the quality of life of sufferers. ⁶ Obesity is a condition that occurs where the quantity of body fat tissue in relation to total body weight is greater than normal. ⁷

Diabetic ulcer complications in patients with type 2 diabetes mellitus are one of the most common cases treated in hospitals. There are several modifiable factors, including obesity. Condition obesity can cause insulin resistance which results in atherosclerosis so that happen disturbance circulation blood in the legs that can cause ulcer diabetic. Incident obesity can known with count index mass body weight (BMI). A person can it is said obesity If index mass body weight $\geq 23 \text{ kg/m}^2$. ⁸

METHOD

Study This done with use method *literature review* aiming For identify & summarize articles that have been published previously, avoid duplication research, and search field studies new that has not been investigated use journal national and also internationally acquired from *Google Scholar, Science Direct, Research Gate & National Center for Biotechnology Information (NCBI)*. Keywords used for the search process literature are “ obesity ”, “ ulcer” diabetic ”, and “diabetes mellitus”. Criteria inclusion that is type study quantitative published 5 years final namely 2020 – 2024 which is appropriate with keywords. While criteria exclusion that is journal over 5 years final.

From the results search using keywords as well as criteria inclusion and exclusion For eliminate journal that is not related, 20 journals were obtained from 221 journals. The research flow carried out in writing *literature review* This started from determination topic, search literature based on article database related, selection literature, data processing & conclusions.

RESULTS

Based on results summary after done search, found 20 related journals with influence obesity to ulcer diabetic in patients with diabetes mellitus as following :

Table 1. Study results *literature review*

No.	Title	Writer	Method	Results
1.	<i>The Relationship of Obesity to Diabetic Foot Ulcer in Type 2 Diabetes Mellitus Patients</i> ⁹	<i>Widyatmoko, et al. all. 2022</i>	<i>Analytical observational</i>	Research result against 42 respondents show that Diabetes Mellitus patients who experience diabetic foot ulcer as many as 31 people (73.8%) and those who did not experience diabetic foot ulcer as many as 11 people (26.2%). There were 21 patients male (50%) and 21 patients women (50%). As many as subject study with Normal Body Mass Index has diabetes mellitus type 2 with complications diabetic foot ulcers (77.8%), 13 subjects study with Overweight Body Mass Index has diabetes mellitus type 2 with complications diabetic foot ulcers (61.9%), 11 subjects study with Body Mass Index obesity class 1 has diabetes mellitus type 2 with complications diabetic foot ulcers (91.7%). In patients with diabetes mellitus type 2 without complications diabetic foot ulcer with Normal Body Mass Index in 2 people (22.8%), in diabetes mellitus patients type 2 without complications diabetic foot ulcer with Body Mass Index overweight as many as 8 people (38.1%). Then in patients with diabetes mellitus type 2 without complications diabetic foot ulcer with Body Mass Index obesity class 1 found 1 person (8.3%). A Chi-Square test was conducted and it was found p value = 0.166. There is no significant relationship between obesity with incident diabetic foot ulcers in patients with diabetes mellitus type 2.
2.	<i>Prevalence diabetic foot ulcer and associated factors among adult diabetic patients in three referral hospitals in Mogadishu, Somalia</i> ¹⁰	<i>Salad et al. 2023.</i>	<i>Cross Sectional Study</i>	Average age of participants study was 50.9 ± 13.6 years. The prevalence diabetic foot ulcer is 15%. Patients who are overweight weight or obesity (OR 4.63, CI: 2.08-10.30), less get support family in managing diabetes (OR 3.33, CI: 1.74-6.36), and not check your feet regular, more Possible For experienced DFU (OR 1.99, CI: 1.08-3.66).

No.	Title	Writer	Method	Results
3.	<i>Prevalence and associated factors of diabetic foot ulcer among type 2 diabetes patients attending chronic follow up clinics at governmental hospital of Harari Region, Eastern Ethiopia: A 5-year (2013–2017) retrospective study</i> ¹¹	<i>Tola., et al. 2021.</i>	<i>Retrospective study</i>	Data from 502 type 2 diabetes patients were reviewed and included. in analysis end in study This. Prevalence diabetic foot ulcers between type 2 diabetes patients is 21.1%. Marital status moment This lower possibility diabetic foot ulcer by 60% (adjusted odds ratio = 0.40 ; 95% confidence interval : 0.17-0.96). Associated factors with improvement opportunity the occurrence diabetic ulcer is lack of activity physical 2.29 (adjusted odds ratio = 2.29; 95% confidence interval : 1.17-4.48), starting treatment with insulin 4.43 times (adjusted odds ratio = 4.43; 95% confidence interval : 1.84-10.67), obesity 27.76 (adjusted odds ratio = 27. 76; 95% confidence interval : 13.96-55.23), delayed For start act continued 2.22 (adjusted odds ratio = 2.22; 95% confidence interval : 1.03-4.82), history of infection 3.50 (adjusted odds ratio = 3.50; 95% confidence interval : 1.83-6.69), and hypertension 3.99 (adjusted odds ratio = 3.99; 95% confidence interval : 2.08-7.65).
4.	<i>Risk Factor Analysis of Diabetic Ulcus in Diabetes Mellitus Patients.</i> ¹²	<i>Faswita, et al. 2022.</i>	<i>Quantitative</i>	From the results study can concluded that level risk the occurrence Ulcer Diabetic in DM patients based on calculated body weight from results BMI calculation in the Binjai City Health Center area in 2022 is known majority at risk that is as many as 21 people (52.5%), and a minority who did not at risk as many as 19 people (47.5%). This is because of The weight of DM patients at the Binjai City Health Center was calculated based on majority BMI results is at 30-39.9 including in category Obesity. In patients obesity, insulin resistance will more often occurs. Hyperinsulinemia is a the condition that shows that when insulin levels exceeding 10 μ U /ml can cause atherosclerosis which results in vasculopathy, so that result in

No.	Title	Writer	Method	Results
				disturbance circulation blood medium / large on the legs causing legs more easy experience Ulcer Diabetic.
5.	<i>Characteristics and outcomes of diabetic foot ulcers treated with surgical debridement and standardized wound care</i> ¹³	<i>Ahmadi, et al. 2024.</i>	<i>Descriptive cross-section al study</i>	In the research 18.7% of patients were found experience obesity class 1, and no There is patients who experience obesity class 2 or 3. This is confirm importance obesity in the occurrence diabetic foot ulcers. Therefore that, the advantages weight is considered as factor risk independent For diabetic foot ulcer
6.	<i>A Cohort Study on the Outcome of Diabetic Foot Ulcers</i> ¹⁴	<i>Sanjeeviraj, et al. 2023</i>	<i>Cohort study</i>	Distribution type gender among participants Enough balanced, with 56% identified as men and 44% as women. The participants ' BMI was also checked, showing that 42% had a normal BMI (normal range between 18.5 to 24.9), 31% were overweight body weight, and another 27% including in category obesity.
7.	<i>Effects of Nutrition Intervention on Blood Glucose, Body Composition, and Phase Angle in Obese and Overweight Patients with Diabetic Foot Ulcers</i> ¹⁵	<i>Basiri, et al. 2022</i>	<i>Cross-section al study</i>	Twenty nine patient with diabetic foot ulcer aged between 30 and 70 years in a way random assigned to in group treatment (supplement nutrition, diet education, and care standard) or group control (maintenance standard). At the beginning research, average index mass body mass index (BMI) is 33.5 kg/m2 for group treatment and 34.1 kg/m2 for group control. HbA1c decreased in both group, without significant difference between second group. On average, patients in the group treatment lost more A little mass body without fat and get more less fat compared to group control ((3.8 kg vs 4.9 kg) and (0.9 kg vs 3.6 kg), respectively sequentially). Although interaction between group and time No reach significance statistics For variable any research after customized with variable confounders, observed changes relevant in a way clinical.
8.	<i>Prevalence of diabetic foot ulcers and its associated factors</i>	<i>Hirpa, et al. 2023</i>	<i>Cross-section al study</i>	Majority participants (71.6%) were Diabetes Mellitus patients type two. More from half (58.3%) of they

No.	Title	Writer	Method	Results
	<i>among diabetes patients on follow up at public hospitals in West Shewa Zone, Oromia, Ethiopia</i> ¹⁶			diagnosed suffer from DM less of five years. Around one third (31.7%) of participants own habit consumption alcohol. Regarding BMI, 58.3% of participants study is at in normal category and 41.7% of participants study is at in category obesity. Almost half (51.4%) experienced neuropathy peripheral diabetes
9.	<i>Factors Associated With Health-Related Quality of Life in Patients With Diabetic Foot Ulcer: A Cross-Sectional Study From Saudi Arabia</i> ¹⁷	<i>Ayed, et al. 2020</i>	<i>Cross-section al study</i>	There is a relationship between body mass index and the risk of diabetic foot in patients with type 2 diabetes mellitus at Royal Prima Hospital. The prevalence of body mass index 23.0 in type 2 diabetes mellitus at Royal Prima Hospital Medan in 2018-2020 reached 70%. The prevalence of diabetic foot in type 2 diabetes mellitus at Royal Prima Hospital Medan in 2018-2020 reached 54%.
10.	<i>The Relationship of Body Mass Index and Diabetic Foot Risk in Type 2 Diabetes Mellitus at Royal Prima Hospital on Period 2018 to 2020</i> ¹⁸	<i>Simarmata, et al. 2021</i>	<i>Study is observ ational analytic</i>	There is a relationship between body mass index and the risk of diabetic foot in type 2 DM patients at Royal Prima Hospital. The prevalence of body mass index 23.0 in type 2 DM at Royal Prima Hospital Medan in 2018-2020 reached 70%. The prevalence of diabetic foot in Type 2 DM at Royal Prima Hospital Medan in 2018-2020 reached 54%.
11.	<i>The association between body mass index and foot ulcers among patients with diabetes mellitus, Wad Medani, Sudan.</i> ¹⁹	<i>Etilib. 2021</i>	<i>Quantitative</i>	Of the 400 participants, 208 were diagnosed suffer leg ulcers. There are significant relationship in a way statistics between index mass body and diabetic foot ulcers. A total of 134 (56%) of the 239 patients who were overweight weight loss experienced diabetic foot ulcer compared to with 74 (46%) of 161 patients not excess body weight (p=0.04).
12.	<i>Risk factors affecting the degree of diabetic foot ulcers according to Wagner classification in diabetic foot patients</i> ²⁰	<i>Syauta, et all, 2021</i>	<i>Cross Section al Study</i>	Of the 40 samples, it was found that duration of diabetes (p = 0.018), smoking (p = 0.008), ankle-brachial index (p = 0.0001), and NLR (p = 0.028) had significant relationship with degrees diabetic foot ulcer according to Wagner classification. Age (p = 0.364), obesity (p

No.	Title	Writer	Method	Results
				= 0.87) and hypertension (p = 0.73) were not relate in a way significant.
13.	<i>Risk Assessment For Foot Ulcer Among Tunisian Subjects With Diabetes: A Cross Sectional Outpatient Study</i> ²¹	<i>Zantour, et al. 2020</i>	<i>Cross Sectional Study</i>	Among the 230 patients evaluated, the Index mass average body weight is 30.38 ± 5.47 kg/m ² . The excess overweight (BMI 25 to 30 kg/m ²) was found in 37.27% and obesity (BMI > 30 kg/m ²) in 47.72% of the population study.
14.	<i>Risk factors and outcomes of diabetic foot ulcers among diabetes mellitus patients admitted to Nekemte referral hospital, western Ethiopia: Prospective observational study</i> ²²	<i>Bekele, et al. 2020</i>	<i>Prospective observational study</i>	Of 115 patients diabetic foot ulcers treated at home Sick reference Nekemte, 64 (55.65%) are male and average age of participants is 44.4 ± 14.7 years. Fifty eight (50.43%) patients own problem health chronic and 56 (48.69%) had complications of diabetes. From patients with complications, 35 (30.43%) did not experience amputation. Grade 4 diabetic foot ulcers (AOR = 1.7; 95% CI: 1.604, 4.789), inappropriate use of antibiotics appropriate (AOR = 2.526; 95% CI: 1.767, 8.314), excess weight (AOR = 2.767; 95% CI: 1.827, 9.252), obesity (AOR = 3.020; 95% CI: 2.556, 16.397), control glucose poor blood pressure (AOR = 2.592; 95% CI: 1.937, 7.168) and neuropathy (AOR = 1.565; 95% CI: 1.508, 4.822) were predictor from amputation in analysis regression logistics multivariable.
15.	<i>Unraveling shared risk factors for diabetic foot ulcers: a comprehensive Mendelian randomization analysis</i> ²³	<i>Yin, et al. 2023</i>	<i>Cross Sectional Study</i>	Index mass body (BMI) appears as the only one factor significant risk For disease artery peripheral diabetic, polyneuropathy diabetic, and diabetic foot ulcers, regardless from type 2 diabetes, glucose fasting, fasting insulin, and HbA1c. Achievement education stand out as the only one factor significant protective to disease artery peripheral diabetic, polyneuropathy diabetic, and diabetic foot ulcers.
16.	<i>Relation of Wagner Classifications and The Mortality of Diabetic Foot Ulcer</i>	<i>Ridho, et al. 2019</i>	<i>Analytical</i>	Research result show that amount patient diabetic foot ulcer with type sex men 42.4%, women 57.6% at the age of 46-65 years (76.3%) with level

No.	Title	Writer	Method	Results
	<i>Patients Who Were Hospitalized in Cengkareng Hospital</i> ²⁴			education most are high school (30.5%), 42.4% are Mother House stairs. Clinical data patient ulcer show that 58% of the pressure normal blood with Normal Body Mass Index (BMI) 64.4 %, 88% anemia, 49.2% A1C value > 7%, 23.7% lesions single with 62.7% of patients is at in Wagner II classification, 39% of ulcers located on the legs with lesi osteolytic as much as 11.9%, 23% positive culture tests and the most common treatment done is surgery (74.6%). Death rate is 1.7%. With using analysis test Chi Square statistics, it is known that Wagner's classification does not relate with mortality patient treated diabetic foot ulcer stay at home sick (p value > 0.05).
17.	<i>Prevalence of Diabetic Foot Ulcer and Associated Factors among Adult Diabetic Patients Who Attend the Diabetic Follow-Up Clinic at the University of Gondar Referral Hospital, North West Ethiopia, 2016: Institutional-Based Cross-Sectional Study</i> ²⁵	<i>Mariam, et al. 2020</i>	<i>Cross Sectional Study</i>	Research result This obtained obesity [AOR = 2.65; 95% CI: 1.25, 5.83], a possible reason is Because existence more foot pressure high in those who have excess weight and with index mass more body high (BMI), diabetic patients who experience obesity and overweight weight can reduce pattern circulation normal blood in the extremities lower in a way intensive ; as a result, things This can make they experience diabetic foot ulcer.
18.	<i>A Comparative Study of Diabetic Foot Outcome between Normal vs. High BMI Individuals - Is Obesity Paradox a Fallacy in Ulcer Healing?</i> ²⁶	<i>Manikanta, et al. 2019</i>	<i>Cross Sectional Study</i>	Higher BMI and HbA1C tall related with inability For restore legs below, although smoke found own moderate correlation. Individual with normal BMI found own relative recovery more Good than BMI case.
19.	<i>Effect of limb preservation status and body mass index on the survival of patients with limb-</i>	<i>Lin, et al. 2020</i>	<i>Retrospective study</i>	With 729 deaths, the median time endure life expectancy (MST) was 6.14 (95% CI 5.63-6.65) years. Major LEA and BMI were two factors independent which is related with mortality after

No.	Title	Writer	Method	Results
	<i>threatening diabetic foot ulcers</i> ²⁷			customized with age, duration of diabetes, HbA1c levels, comorbidities, and diseases artery peripheral. Ratio danger mortality For minor and major LEA groups were 0.92 (95% CI 0.74-1.16) and 1.34 (95% CI 1.07-1.68), respectively, against group reference (preserved extremity). After grouping BMI into in four categories (underweight, normal weight, overweight, and obesity, according to Taiwan definition), MST for each category were 2.57, 5.24, 7.47 and 7.85 years, respectively (P for trend b 0.01). “ Paradox obesity ” this No observed in the main LEA group (P for trend 0.25). For patient with LEA, patients obesity have more MST low than those who are in category excess body weight (7.97 and 8.84 for minor LEA and 3.25 and 5.42 for major LEA).
20.	<i>Diabetic Foot Complications and Their Risk Factors from a Large Retrospective Cohort Study</i> ²⁸	<i>Al- Rubeaan, et all. 2022</i>	<i>Cross-section al study of a cohort</i>	Hyperlipidemia, excess weight, and obesity associated with decline risk in a way significant For all affected cases impact, ulcers, gangrene, and amputation, except hyperlipidemia in cases gangrene and excess weight among amputees

Discussion

Diabetes Mellitus includes group disturbance metabolic with characteristics hyperglycemia that occurs Because insulin abnormalities caused disturbance work and or insulin secretion. Diabetes mellitus is a silent killer disease, caused by the amount sufferers who do not realize before the occurrence complications. There are two categories of DM, namely type 1 DM and type 2 DM²⁹ . DM occupies ranked 6th as reason death. Approximately 1.3 million people died. due to diabetes and 4% die before age 70 years. In 2030 it is estimated that DM will occupy 7th cause order world deaths. In Indonesia it is estimated that by 2030 there will be own DM (diabetes) sufferers total 21.3 million people. ⁶

According to Ada (2019) he stated that there is one person diagnosed diabetes mellitus disease every 21 seconds, or almost half from adult population in the United States suffer from disease this. Diabetic foot ulcers is One complications, estimated at 15% of all diabetes mellitus sufferers experience complications this. Diabetic foot ulcer is non- traumatic lesions on the skin (most or all over layers) on the feet of people with diabetes mellitus. Diabetic foot

ulcers usually caused by pressure repeated (shear and pressure) on the feet with existence complications related to diabetes mellitus from neuropathy peripheral or disease artery peripheral, and its healing often complicated by the development of infection. ³⁰

Diabetic foot ulcer is serious complications, complications extremities lower This appear as problem proper health be noticed in a country proceed and also developing. Causes main diabetes sufferers treated at home Sick is diabetic foot ulcers and amputations is serious consequences from diabetic foot ulcer as well as the occurrence death after. ³¹

The World Health Organization (WHO) shows reason number One number death in the world is disease No contagious, reaching figure of 71%. In addition, WHO also mentioned that happen improvement sufferer ulcer diabetes in the adult population, namely recorded 122 million people suffer ulcer diabetics in the world. Especially in countries with low economic status. middle and low. Estimated at the age of not enough from 70 years there is the number 2.2 million death caused by ulcers diabetic. Even will Keep going happen improvement amounting to 600 million souls by 2035 WHO. ³⁰

Obesity can make insulin resistance which results in atherosclerosis so that happen disturbance circulation blood in the legs that can causes diabetic feet. Research by Al Rubean, Derwish and Ouzi et al (2015) found that obesity is risk factors causes diabetic foot. Diabetic foot can happen Because existence various factor risks, including obesity factor. ³²

Obesity or obesity is one of problem excess nutrition that can influence productivity work. Event obesity can known with count Body Mass Index (BMI). A person it is said obesity if $BMI \geq 23 \text{ kg/m}^2$ There is correlation meaningful between obesity with level glucose blood, namely degrees obesity $BMI \geq 23$ can cause improvement level glucose blood to 200 mg% ³²

Research by Masi and Oroh (2018) found that that Diabetes Mellitus is very closely related the relation with obesity. obesity cause response pancreatic beta cells to improvement glucose blood reduced, besides That insulin receptors on cells throughout the body including in muscles reduce the amount and less sensitive. Obesity can also associated with pattern eating and pattern monotonous life. Insulin resistance increases with existence obesity that can obstruct taking glucose to in muscles and fat cells so that glucose in blood increased. Research by Nasution et al (2018) also found that obesity is factor risks involved important to Diabetes Mellitus disease. If happen obesity body will more difficult in using the insulin produced, this This named condition insulin resistance. ⁸

But in the journal other studies also contain contradictory research, that No there is connection between activity physical and obesity. In addition there is research at Dr. Regional General Hospital. Soedarso and Kitamura Clinic Pontianak do not There is significant relationship between activity physical and obesity with diabetic ulcer. ⁸

CONCLUSION

Diabetes mellitus is a silent killer disease, caused by... the amount sufferers who do not realize before the occurrence complications. Diabetic foot ulcers is non- traumatic lesions on the skin (most or all over layers) on the feet of people with diabetes mellitus. Risk factors can influence incident DM ulcers are obesity, condition obesity can cause insulin resistance which

results in atherosclerosis so that happen disturbance circulation blood in the legs that can cause diabetic ulcer.

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