Archives of The Medicine and Case Reports
Journal Homepage: https://hmpublisher.com/index.php/AMCR/index
eISSN: 2747-2051

The Relationship of Body Mass Index and Diabetic Foot Risk in Type 2 Diabetes Mellitus at Royal Prima Hospital on Period 2018 to 2020

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ARTICLE INFO

Keywords:
Diabetes mellitus
Diabetic foot
Hyperglycemia
Neuropathy
Body mass index

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All authors have reviewed and approved the final version of the manuscript.
https://doi.org/10.37275/AMCR.v2i4.126

ABSTRACT

Body mass index (BMI) is a simple method that is commonly used to determine whether a person is obese or not. Diabetes mellitus is a disorder of the metabolic system because the pancreas cannot produce enough insulin or the body's cells cannot use insulin effectively. Diabetic foot is one of the chronic complications of diabetes mellitus (DM). Diabetic foot begins with hyperglycemia which causes abnormalities in neuropathy and blood vessels, causing infection. To determine the proportion of body mass index in patients with diabetes mellitus, to determine the prevalence of diabetic feet and non-foots. The research design used in this study is observational analytic. There is a relationship between body mass index and the risk of diabetic foot in type 2 DM patients at Royal Prima Hospital. Prevalence of body mass index 23. 0 in DM Type 2 at Royal Prima Hospital Medan in 2018-2020 reached 70%. The prevalence of diabetic foot in Type 2 DM at the Royal Prima Hospital Medan in 2018-2020 reached 54%.

1. Introduction

In Indonesia, the problem of overnutrition is still often encountered. Overnutrition occurs as a result of economic progress in certain communities accompanied by a lack of public knowledge about health, nutrition, and a balanced menu. Nutritional status of each individual is influenced by intake and use of the body, nutritional status can be assessed by measuring body mass index (BMI). Body mass index is a simple method that is commonly used to determine whether a person is obese or not. Obesity is an abnormal accumulation of excess fatty tissue under the skin. Obesity is caused by the intake of food in greater quantities than its users as energy for the body. The risk of developing diabetes mellitus increases with an increase in body mass index more than normal. Being overweight can make the body's cells insensitive to insulin (insulin resistance). Insulin plays a role in increasing glucose uptake in many cells and in this way insulin also regulates carbohydrate metabolism, so that if there is insulin resistance by cells, sugar levels in the blood can also be disrupted. The World Health Organization (WHO) in 2015 showed that more than 1.9 billion adults over 18 years were overweight and more than 600 million people were obese[1]. Based on the Indonesian Basic Health Research in 2018,[2] the prevalence of nutritional status based on body mass index measurements at age >18 years in North Sumatra that most citizen in North Sumatra suffer from obesity.[2]

Diabetes mellitus is a disorder of the metabolic system because the pancreas cannot produce enough insulin or the body's cells cannot use insulin effectively. Insulin is a hormone that regulates the balance of blood sugar levels, an increase in the concentration of glucose in the blood is called hyperglycemia.[3] Diabetes mellitus incidence is increasing from year to year and can be diagnosed if there are symptoms of polyuria, polydipsia, polyphagia, and weight loss for no apparent reason with plasma glucose 200 mg/dL or fasting glucose 126 mg/dL or plasma glucose 2 hours postprandial at OGTT 200mg/dL. Type 2 diabetes mellitus is caused by insulin resistance accompanied by insulin deficiency and occurs in adulthood.[4] Based on the International Diabetes Foundation (IDF) in 2019, around 351.7 million people aged between 20 to 64 years were diagnosed with diabetes.[4] Based on the Indonesian Basic Health Research in 2018, the prevalence of diabetes mellitus based on a doctor's diagnosis in the population aged 15 years was 2%, and the prevalence in North Sumatra was 2.03% and in the city of Medan 2.31% of the total population.[2]

Diabetic foot is one of the chronic complications of diabetes mellitus. Diabetic foot begins with hyperglycemia which causes abnormalities in neuropathy and blood vessels, causing infection. In Indonesia, diabetic foot ulcers are still not getting enough attention because diabetic foot service facilities are still very limited and very lacking.[5] Diabetic foot is characterized by the presence of ulcers on the feet without pain or arthropathy and is a typical complication of diabetic neuropathy.[6]

Diabetic foot ulcer (DFU) is one of the most dreaded chronic complications of diabetes mellitus. DFU is a disease of the feet of diabetics with the characteristics of sensory, motor, autonomic neuropathy as well as macrovascular and microvascular disorders. DFU is a major morbidity and cause of hospitalization for diabetics. A multidisciplinary approach is needed to treat DFU disease. Early detection and adequate treatment will reduce the incidence of amputation. Ironically, early evaluation and adequate treatment in the hospital are not optimal. This study aims to present the description of diabetic foot ulcer in diabetes mellitus.

2. Methods

This study used observational research design. This reseach was conducted from March to June 2021 at at the Royal Prima Hospital, Medan, Indonesia. The target population of the study was all type 2 DM patients at Royal Prima Hospital. The patient's affordable population is type 2 DM patients at Royal Prima Hospital in 2018-2020. The sampling technique used is simple random sampling. A total of 100 participants were included in this study. The inclusion criteria in the study were Type 2 diabetes mellitus patients at Royal Prima Hospital who were recorded in the medical record. The exclusion criteria in the study were incomplete medical records and aged less than 40 years old.

3. Results

In this study, the amount of female participant was more than male (58%). The majority of the samples are in the age group of 40-45 years and 56-60 years (18%). However, the participants in 71-75 year age group are two percent from total sample. The BMI value for participants is mostly found at 23.0 (70%). Based on table 2, it can be concluded that there is no significant relationship between body mass index and the risk of developing diabetic foot.

Table 1. Characteristics of participants

Characteristics	Frequency	Percentage (%)
Gender		
Male	42	42
Female	58	58
Age		
40-45 y.o.	18	18
46-50 y.o.	14	14
51-55 y.o.	16	16
56-60 y.o.	18	18
61-65 y.o.	14	14
66-70 y.o.	6	6
71-75 y.o.	2	2
76-80 y.o.	4	4
81-86 y.o.	8	8
Body mass index		
< 23.0	30	30
≥23.0	70	70

Table 2. Relationship between body mass index and diabetic foot status

	Diabetic Foot Status				
Body mass index	Yes		No		Total
	Frequency	%	Frequency	%	
< 23.0	8	8	22	22	30
≥ 23.0	46	46	24	24	70
Total	54	54	46	46	100

4. Discussion

Distribution of participants

This study found that most participant are female and the majority of the samples are in the age group of 40-45 years old and 56-60 years old. A research by Tini in 2018 found that the majority in this study gender was women (80%). Gender can also affect the occurrence of obesity, in this study the majority of respondents were 67 people (65.7%) women.[8]

It can be seen that eighteen percent of the samples were in the age group of 40-45 years and 56-60 years old. Increasing age is one of the factors that influence the incidence of diabetes mellitus.[9] People aged 45 years have a greater risk of developing type 2 diabetes mellitus than those aged more than 45 years. The theory put forward by Goldberg and Coon states that at the age of 45 years there are anatomical, physiological and biochemical changes in the body. Changes start at the cellular, tissue level, and finally there are changes in organs including the pancreas that can affect homeostatic function.[10-13]

Based on body mass index, the majority of the samples had BMI more than 23.0, which was 70% of the total sample. The research conducted Liu et al., found that the most participant has excess BMI category (53.6%). Body mass index (BMI) is a measure used to assess the proportionality of the comparison between a person's height and weight. BMI is often used by doctors to assess whether a person is obese or not. BMI is a technique for calculating body weight index, so it can be seen whether our body category is classified as thin, normal and obese (overweight). Excessive food intake and not balanced with the number of calories expended through physical activity causes the process of fatty acid biosynthesis or lipogenesis and adipose storage in fat tissue. Lipogenesis converts excess glucose and other intermediates such as pyruvate, lactate, and acetyl CoA into fat. This process takes place in the cytosol of the

cell, consisting of repeating various reactions such as condensation, reduction, dehydration, and re-reduction. In the condensation reaction, acetoacetyl ACP is formed from acetyl ACP and malonyl ACP, and CO2 is released. [14-16]

Relationship between body mass index and diabetic foot risk

This study aims to determine the relationship between body mass index and the risk of diabetic foot in type 2 diabetes mellitus. 46 people who do not have diabetic foot, and 70 respondents who have a BMI of 23.0 kg/m2, and 30 respondents who have a BMI <23.0 kg/m2. This study uses a case control design with a retrospective approach. After collecting data, a chi-square test was carried out, based on the results of the cross-tabulation obtained a P value of 0.161 (P > 0.05), it can be concluded that there is no significant relationship between diabetic foot and body mass index.

This study is also in accordance with research conducted by Mineoka et al., there is a significant relationship between body mass index and the risk of diabetic foot Based on this study, it was found that there was no relationship between body mass index and diabetic foot (p= 0.591).[17] Based on former studies, it can be concluded that there is no significant relationship between body mass index and the risk of diabetic foot. This condition is influenced by several factors such as genetics, physical activity, dietary intake, metabolism, and hormones.[18-19]

5. Conclusion

There is no relationship between body mass index and the risk of diabetic foot in type 2 DM patients at Royal Prima Hospital. Most of participants have overweight body mass index value and have diabetic foot.

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