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The Relationship Between Body Mass Index and Blood Sugar Levels In Students of The Faculty of Medicine, University of Muhammadiyah North Sumatera 2021

Gilang Maghriba*, Amelia Eka Damayanti

Universitas Muhammadiyah Sumatera Utara

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*Correspondence: Gilang Maghriba
Email: gilangMaghriba@gmail.com

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Abstract: Blood sugar levels are the glucose present in the blood originating from carbohydrates in meals and can be stored in the form of glycogen in the liver and skeletal muscles. If blood sugar levels are excessively high, it can lead to a condition called hyperglycemia, which if left untreated can lead to a metabolic disorder called Diabetes Mellitus. Diabetes mellitus has several complications, one of which is obesity. BMI is one of the methods used to determine whether a person is affected by diabetes or not. To investigate the relationship between body mass index (BMI) and fasting blood sugar levels among students of the 2021 intake at the Faculty of Medicine, University of Muhammadiyah North Sumatra. A cross-sectional approach was used, with data collected once at the same time. Data was collected using a glucometer to measure fasting blood sugar levels, an analog scale to measure body weight, and a stature meter to measure height. The Mann-Whitney test for body mass index with fasting blood sugar levels yielded a result of P>0.05. The result of this study is that there is no relationship between BMI and fasting blood sugar levels among students.

Keywords: Fasting Blood Sugar Levels, Obesity, BM

Introduction

Blood sugar levels are sugars in the blood that come from carbohydrates in meals and can be put in the form of glycogen in the liver and skeletal muscle1. If the sugar level in the blood is too high, it will lead to a condition called hyperglycemia which if left untreated will give rise to a metabolic disease called Diabetes Mellitus (DM) (Hermayanti, 2018).

Diabetes Mellitus is divided based on its causes into three main types: Type 1 Diabetes Mellitus, Type 2 Diabetes Mellitus, and Diabetes Mellitus which occurs during pregnancy. Type 2 diabetes mellitus is the most common type of diabetes mellitus, estimated to account for 90-95% of all cases of diabetes mellitus, with about 90% of sufferers also obese. According to a study involving subjects aged between 20-59 years, out of a total of 17 study subjects who were obese, it was found that 15 people experienced increased blood sugar levels, while 2 other people had normal blood sugar levels (Justitia, 2011). The results of the study showed that people who were obese were more likely to have high blood

sugar levels. These findings come from a study that aimed to explore the relationship between body mass index (BMI) and fasting blood glucose levels in Niti Mandala Renon field visitors in July 2018. In the study, it was found that there was a weak but significant positive correlation between BMI and fasting blood glucose levels in the field visitors (Goddess & Mahartini, 2019).

The results of another study showed that there was a relationship between obesity and blood sugar levels in employees at Level IV Hospital Madiun. These findings are supported by research that found that 12% of study subjects who had a body mass index of 27 kg/m2 also had type 2 diabetes mellitus. Unhealthy environmental and lifestyle factors, such as excessive consumption of fatty foods and lack of physical activity, also contribute as triggers of diabetes mellitus (Purwandari, 2014). Another study conducted on public high school students in the North Denpasar area showed an insignificant correlation between body mass index (BMI) and fasting blood sugar levels (Dwipayana, 2018).

Based on a literature review, there is an inconsistency in the results of research regarding the relationship between Body Mass Index (BMI) and fasting blood sugar levels (KGDP). Several studies report a significant positive association between BMI and KGDP, especially in the adult and elderly populations. On the other hand, studies on young adolescent populations, such as high school students in Denpasar, showed the absence of a significant relationship. The group of medical students, who had unique characteristics of young adulthood, activity patterns, and academic stress, had not been extensively studied as subjects to look at this relationship. Therefore, further research is needed in this population to clarify the contradiction. The novelty of this study lies in its focus on the student population of the Faculty of Medicine class of 2021.This population has special characteristics, namely a relatively young age (early adulthood), a high academic burden that can affect diet and stress, and a level of health knowledge that may be better than the general population of its age. Examining the relationship between BMI and KGDP in this group can provide an initial picture of the risk of metabolic disorders in prospective health workers in Indonesia.

This study generally aims to analyze the relationship between Body Mass Index (BMI) and fasting blood sugar levels (KGDP) in students of the Faculty of Medicine, University of Muhammadiyah North Sumatra class of 2021. Specifically, the objectives of this study are:

Describe the distribution of Body Mass Index (BMI) in students, Describe the average fasting blood sugar level (KGDP) in students, Analyze whether there is a significant relationship between BMI and KGDP. To determine whether a person is overweight or normal weight, we can use a method called Body Mass Index (BMI). BMI is a way to assess whether a person's weight falls into the normal category or not.

The BMI method uses data on a person's weight and height. One of the advantages of the BMI method is its ability to determine whether a person is overweight, underweight, or has a normal weight. The disadvantage is the limitation of several factors such as gender due to the different physiology between males and females. The formula used in calculating BMI is body weight (in kilograms) divided by the square of height (in meters). In determining BMI, there are factors that cannot be changed such as genetic factors and

gender, but there are also factors that can be modified such as diet and physical activity. Similar to blood sugar levels, there are factors that cannot be changed such as genetic factors, but there are also factors that can be modified such as carbohydrate consumption, physical activity, obesity, and diet (Yusuf, 2019).

Methodology

This study uses an analytical research method with a cross-sectional approach, which is collecting data at a time to the sample. The research time was carried out from June to August 2023 with the research being carried out at the UMSU Faculty of Medicine. The population in this study is FK UMSU students. The research sample was taken from FK UMSU students using purposive sampling technique. This method uses criteria that have been selected by the researcher in selecting samples, namely inclusion and exclusion criteria where the inclusion criteria are FK UMSU students of the 2021 batch, willing to participate in research by filling out informed consent, Willing to be subjected to blood tests. The exclusion criteria are students who are on academic leave, students who consume anti-Diabetes drugs, students who suffer from type I and II DM. For KGDP data, samples were taken from students who had fasted or did not eat and drink for 8 hours and were taken in the morning because at that time there was no food and drink entering the body.

This study uses a cross sectional approach with purposive sampling technique because the cross-sectional design allows data collection only at one time (single point in time). It is very efficient for researching student populations that have limited time and for answering research questions that focus on the relationships between variables at a given moment, without the need to follow the subject in the long run.

The data used in this study is primary data. In this study, the techniques used for primary data collection were analog scales and stature meters to measure BMI and glucometers to measure fasting blood glucose levels. The instruments used to measure body mass index in this study were a scale used to measure weight and a stature meter to measure height and a glucometer to measure glucose levels in the blood. The hypothesis of this study was tested using Statistical Packages for Social Science (SPSS).

Result and Discussion

Univariate Analysis

Descriptive statistics are used to communicate a data with a simple one. One type of descriptive statistical presentation is frequency distribution. The following are the results of the frequency distribution listed in the following table.

Table 1. Gender Frequency Distribution Table

Gender	Frequency	Percentage
Man	27	32.5
Woman	56	67.5
Total	83	100

Based on the table above, information was obtained that of the 83 respondents used for the study, the results of 27 respondents with male gender with a percentage of 32.5% and respondents with female gender as many as 56 respondents with a percentage of 67.5%.

Table 2. BMI Frequency Distribution Table

IMT	Frequency
Below normal	6
Normal	30
Risk	12
Class 1 Obesity	23
Class 2 Obesity	12
Total	83

Based on the table above, information was obtained that from 83 respondents used for the study, the results were obtained in the BMI 6 respondents had very thin criteria with a percentage of 7.2%, 30 respondents had normal criteria with a percentage of 36.1%, 12 respondents had risk criteria with a percentage of 14.5%, 23 respondents had class 1 obesity criteria with a percentage of 27.7% and 12 respondents had criteria for class 2 obesity with a percentage of 14.5%.

Table 3. Results of Cross-Sex Tabulation with BMI

Gender	IMT					Total
	elow normal N(%)	Normal N(%)	Risk N(%)	Class 1 Obesity N(%)	Class 2 Obesity N(%)	
Man	1(3.7%)	9(33.3%)	2(7.4%)	9(33.3%)	6(22.2%)	27(100.0%
Woman	5(8.9%)	21(37.5%)	10(17.9%)	14(25.0%)	6(10.7%)	56(100.0%)
Total						83

Based on table 3, information was obtained that the majority of males have a risk BMI of 33.3% and class 1 obesity of 33.3% while the majority of females have a normal BMI of 37.5% and class 1 obesity of 25%

Table 4. Table of Average KGDP by Gender

Gender	KGDP (mg/dl)
Man	96,37
Woman	94,26

Based on the table above, information was obtained that the male sex has an average KGDP of 96.37mg/dl and the female sex has a sex of 94.26mg/dl

Table 5. Table of KGDP values by BMI

Group	Mean KGD fasting(mg/dl)	Median KGD Fasting (mg/dl)
Below normal	95	97(70-110)
Normal	92,23	94,5(62-112)
Risk	96,63	95(85-122)
Obesity class 1	99,82	98(80-130)
Grade 2 obesity	91,16	96,5(59-101)

Bivariate Test

Based on the results of data analysis using the Mann Whitney test with the help of SPSS 26 software, the following results were obtained:

Table 6. Hypothesis Test Results

IMT	Mean KGD Fasting(mg/dl)	Median KGD Fasting(mg/dl)	P-value
Below Normal	95	97 (70-110)	0,986
Normal	92,23	94.5 (62-112)	
Risk	96,63	95 (85-122)	
Obesity class 1	99,82	98 (80-130)	
Grade 2 obesity	91,16	96.5 (59-101)	

Based on the table above, the Sig. value is 0.986 > 0.05, this means that H0 is accepted and H1 is rejected. Thus, it can be decided that there is no difference in KGDP based on BMI.

Discussion

In table 3, it is shown that people with excess BMI are more obtained from male respondents than female respondents, namely 62.9% vs 53.6%, this is in line with previous research which said that men are more likely to experience obesity than women, this is because men have a faster fat distribution, the cause is the physiology of the male body which is slightly faster metabolism than women plus high nutritional needs but not accompanied by a good diet (Adha & Rachmania, 2019).

In table 6, it is shown that abnormal KGDP sufferers are more likely to come from the male gender, namely 33.3% vs 28.6%, high KGD in males Caused Insulin resistance causes too much sugar to be contained in the blood, when sugar is consumed sugar will turn into glucose, this glucose will enter the blood which will later enter the cells through the help of insulin, but in some cases insulin cannot work properly it can be caused by a decrease in insulin secretion by the pancreas or the presence of insulin resistance which is more risky to occur in men, eventually causes the insulin receptors to be unable to process

the signals from insulin. There are several risk factors that cause this, namely an unbalanced diet, genetic factors, minimal physical activity, and obesity or excessive BMI (Bruns & Kemnitz, 2020).

From table 4.2.1 it was shown that there was no difference in KGDP based on BMI. From the results of this study, it was found that BMI does not affect KGDP, this is in line with previous research where The results of an analysis of a previous study showed that research subjects who had a BMI of > 30 kg/m2 did not find high blood glucose levels, as well as individual individuals who had a BMI < 18.5kg/m2, both were not found to have high blood sugar levels even though they were individuals who had a BMI > 30 kg/m2 or who had IMT<18.5kg/m2. This can happen because there are pathophysiological differences that are almost unrelated to each other, high BMI is caused by the accumulation of fat that comes from unused calories, when the body consumes food, the food will be processed into calories, these calories will be the body's fuel to carry out activities, but when the body is still or does little physical activity the calories that have been formed will not be used until eventually they will be stored as fat. While high KGD is caused by sugar that cannot enter the cell due to lack of insulin, when the body consumes carbohydrates/sugars the body will convert it into glucose which will be sent to the blood which will later be used by the cells, when the cell wants to use the glucose in the blood the body will produce insulin which causes the glucose to enter the cell but in some cases the insulin cannot make glucose enter the cell this can happen Because insulin cannot be produced by the pancreas or insulin resistance occurs. Thus, this is the reason why people who have a high KGD will not necessarily be affected by a high BMI, and vice versa (Astutisari & Wulandari, 2022) (Ernawati, Signa, Gumilas, 2020) (Manaf, 2014).

From a study it is stated that excess BMI can cause pancreatic fat, pancreatic fat is a condition where the pancreas is covered by fat, this will cause disturbances in insulin secretion which will cause the incidence of diabetes mellitus, but the incidence of pancreatic fat is more susceptible to occur in individuals who have an age in the range of 41-70 years,' KGD and BMI can be interrelated which is influenced by several factors such as age, how long you have been suffering from obesity or type 2 DM, how severe are the complications of type 2 DM or obesity and complications of a disease occur (Axel &Tantoso, 2023) (Berliana, 2023) (Gultom, 2023).

Conclusion

Based on the results of this study, it can be concluded that the 2021 UMSU FK students are in the risk category based on BMI, while the average KGDP is in the normal category. The study also did not find a significant association between BMI and KGDP. The authors suggest expanding the sample variation because the study only involved students. The authors also suggest an age analysis to assess its effect on BMI and KGDP because these variables have not been included due to resource limitations. This study has limitations in the form of a less diverse sample and limited independent factors, including the absence of age variables.

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