DOI: http://dx.doi.org/10.33846/hn60404
http://heanoti.com/index.php/hn

RESEARCH ARTICLE
URL of this article: http://heanoti.com/index.php/hn/article/view/hn60404

Correlation of Fasting Blood Glucose Levels and HbA1c with Body Mass Index in Type 2 Diabetes Mellitus Patients

Anik Handayati[1], Lully Hanni Endarini[2(CA)], Yuni Eka Cahyana[3]
[1]Department of Medical Laboratory Technology, Poltekkes Kemenkes Surabaya, Indonesia;
anik_handayati@yahoo.co.id
[2(CA)]Department of Medical Laboratory Technology, Poltekkes Kemenkes Surabaya, Indonesia;
lendarini@poltekkesdepkes-sby.ac.id (Corresponding Author)
[3]Student of Department of Medical Laboratory Technology, Poltekkes Kemenkes Surabaya, Indonesia;
yuniec88@gmail.com

ABSTRACT

Excess body mass index is at greater risk of developing diabetes mellitus than other diseases. Monitoring blood glucose includes through examination of fasting blood glucose levels and HbA1c. This study aims to find out the relationship of fasting blood glucose levels and HbA1c with Body Mass Index in type 2 diabetes mellitus patients. This study was an observational analytical study with a cross sectional design. The research was conducted at Prima Surabaya Main Clinic in January to June 2021. The sample was a type 2 diabetes mellitus patient who conducted fasting blood glucose examination, HbA1c and Body Mass Index measurement at Prima Surabaya Main Clinic as many as 40 people, were taken purposive sampling. The results of this study found that the average fasting blood glucose level of patients with type 2 diabetes mellitus was 172.6 mg / dL and HbA1c was 7.76%. The average Body Mass Index was 24.97. Pearson correlation test results obtained significant Body Mass Index with fasting blood glucose levels p = 0.150 and HbA1c with Body Mass Index p = 0.295, which means there is no relationship between fasting blood glucose levels and HbA1c with body mass index in type 2 diabetes mellitus patients.

Keywords: fasting blood glucose; HbA1c; Body Mass Index; auto analyzer

INTRODUCTION

Diabetes Mellitus (DM) or "sugar pain" is interpreted as an increase in blood glucose levels as a result of the body's inability to process carbohydrates or glucose due to lack of insulin or insulin does not function perfectly (insulin resistance occurs in the body). WHO has previously formulated that DM is a collection of anatomical and chemical problems resulting from a number of factors where absolute or relative insulin deficiency and impaired insulin function (1)

The prevalence of diabetes continues to increase by a large proportion in the world. In Indonesia, the number of diabetics is expected to increase from 8.4 million sufferers in 2000 to about 21.3 million sufferers by 2030. In 2013, Indonesia was ranked 7th in the world and is expected to be ranked 6th in the world in 2030 in terms of the number of diabetics (ADA, 2019). People with DM aged between 20-79 years based on data from Regional Health Research (Riskesdas), showed that the prevalence of diabetic patients in East Java province entered the top 10 in Indonesia with a prevalence of 6.8% (2)

The diagnosis of DM should be based on an examination of blood glucose levels. In determining dm type 2 must be considered the origin of the blood material taken and the way of examination used. Generally, it is to do a fasting blood glucose and blood glucose examination 2 hours after eating, with the preparation of patients should fast between 8-10 hours before the examination (for examination and results at the time of examination on that day, because blood glucose levels can change), while for long-term blood glucose control can be done with HbA1c examination (3)

The HbA1c level test can monitor blood glucose levels because in the HbA1c test blood glucose levels are not affected by daily glucose fluctuations. HbA1c level examination can provide information about the patient's

glycemic control during the previous 2-3 months and can be used alongside 3 regular blood glucose checks to make adjustments in DM control [(4)]

With a series of tests, dm sufferers can control DM independently which can also be obtained from the direction of competent people (Specialist dr. or nurse and laboratory who understand the problem). Health problems can be affected by lifestyle, diet, work environment, exercise and stress, lifestyle changes, especially in big cities, leading to an increasing prevalence of degenerative diseases such as DM [(5)]. People with excess Body Mass Index (BMI) (obesity) have a greater risk of DM than the risk of other diseases. In other words, type 2 DM and body mass index are related. Adnan research [(6)] which examined the relationship of body mass index (BMI) with blood glucose levels of people with diabetes mellitus (DM) type 2 outpatient at Tugurejo Hospital Semarang showed that there is a relationship between body mass index and blood glucose levels of people with Type 2 diabetes mellitus, the higher the value of body mass index, the higher the blood glucose level. While Budiamal research [(7)] which examined the relationship between fasting blood glucose and HbA1c with Body Mass Index in people with Type 2 DM at Pratama Mutiara Clinic, Salatiga city showed no relationship between fasting blood glucose and HbA1c with Body Mass Index in people with Type 2 DM.

METHODS

This study was an observational analytical study with a cross sectional design. This study aimed to find out the relationship of blood glucose levels and HbA1c with Body Mass Index (BMI) in people with type 2 diabetes mellitus at Prima Surabaya Main Clinic with data collection done at one time. The research was conducted at Prima Surabaya Main Clinic in January 2021 to June 2021. The population in this study was a type 2 diabetes mellitus patient who conducted fasting blood glucose examination, HbA1c and BMI measurement at Prima Surabaya Main Clinic. The samples used in this study were type 2 diabetes mellitus patients who conducted fasting blood glucose examinations.

The independent variable in the study was BMI, while the dependent variables were fasting blood glucose levels and HbA1c levels. The principle procedure for checking HbA1c was more or less the same as the procedure for a blood test in general with ethic statement. Blood was drawn from a vein in the arm. The blood sample was then tested in the laboratory, and the results could be obtained within a few days. HbA1c and BMI measurements at Prima Surabaya Main Clinic as many as 40 people were taken purposive sampling, with research samples that met the inclusion criteria, patients diagnosed with type 2 diabetes mellitus, aged >19 years, did not do insulin therapy and did not take drugs that affect blood glucose levels.

The research stage includes patients with diabetes mellitus asked to stand on the scales to measure their weight. Then stand firm to measure height using a stadiometer. BMI was obtained by the formula: BMI = Weight (kg) / (height in m)^2. Furthermore, patients were taken 5 ml of blood and measured fasting blood glucose levels using autoanalyzer TMS 24i Premium and HbA1C using Epithod R 616 HbA1c. Data were analyzed using Spearman correlation tests.

RESULTS

Based on the results of BMI measurements and examination of fasting blood glucose and HbA1c levels in 40 patients with type 2 diabetes mellitus at Utama Prima Clinic Surabaya.

Table 1. Distribution of age

Age	Frequency	Percentage
<45	1	2,5
45-54	6	15
55-65	13	32,5
>65	20	50

Based on table 1, most respondents aged >65 years as many as 20 people (50%).

Table 2. Distributio of gender

Gender	Frequency	Percentage
Male	14	35
Female	26	65

Based on table 2, most of the respondents were female as many as 26 people (65%).

Table 3. Descriptive analysis results

	Minimum	Maximum	Mean	SD
BMI	19.53	31.25	24.97	3.09
Blood glucose level	87.00	322.00	172,6	52.14
HbA1C	6.80	12.10	7.76	0.99

Based on table 3, the average of BMI of type 2 diabetes mellitus patients was 24.97, the average fasting blood glucose level was 172.6 mg / dL and the average HbA1c was 7.76%.

Based on the results of the normality test Kolmogorov Smirnov test obtained a p-value on BMI was 0.965, in fasting blood glucose was 0.452 and HbA1c was 0.217, means distribution of BMI, GDP and HbA1c data were normal.

Based on the results of Pearson correlation tests obtained p-value of BMI with fasting blood glucose was 0.150 (>0.05) meaning there was no correlation between BMI and fasting blood glucose levels in patients with type 2 diabetes mellitus. The p-value for BMI and HbA1c was 0.295 (>0.05) meaning there was no correlation between BMI and HbA1c in patients with type 2 diabetes mellitus.

DISCUSSION

The results of body mass index (BMI) measurements and examination of fasting blood glucose and HbA1c levels in 40 patients with type 2 diabetes mellitus at Prima Surabaya Main Clinic obtained an average Body Mass Index of type 2 diabetes mellitus patients of 24.97 or within normal limits of average fasting blood glucose levels of 172.6 mg / dL (high) and average HbA1c glucose levels of 7.76% (high).

Fasting blood glucose obtained results there is no association between BMI and fasting blood glucose levels in patients with type 2 diabetes mellitus (p = 0.150). The results of this study are in line with Suryanti's research [(8)] which examined the relationship of body mass index with fasting blood glucose levels in Patients with Type 2 Diabetes Mellitus in Hospital Nutrition Dr Saiful Anwar the results of the study showed no association between body mass index and fasting blood glucose levels in Patients with Type 2 Diabetes Mellitus.

The results of the data analysis on the relationship between BMI and HbA1c levels obtained the same result that there is no relationship between BMI and HbA1c levels in patients with type 2 diabetes mellitus (p = 0.295). The results of this study are in line with Budiamal research [(8)] which stated that there was no association between fasting blood glucose and HbA1c with body mass index in people with type 2 DM at Pratama Mutiara Clinic, Salatiga city.

There is no association between fasting blood glucose and HbA1c and body mass index in type 2 DM patients due to several factors including type 2 DM patients experiencing central obesity. This is indicated by a body mass index that tends to be normal while fasting blood glucose and HbA1c levels are high. Central obesity cannot be measured by BMI because most have a normal BMI, detection is obtained by measuring the circumference of the abdomen / waist.

Central obesity is defined as the accumulation of fat in the body of the abdomen. This buildup is caused by the amount of excess fat in subcutaneous fat tissue and visceral belly fat [(9)]. Central obesity is associated with decreased glucose tolerance, changes in glucose-insulin homeostasis, and decreased glucose-stimulated insulin expenditure. In individuals with central obesity, there is an increase in the amount of uneserfied fatty acids, glycerol, hormones, cytokines, proinflammatory markers, and other substances involved in insulin resistance and cell damage β the pancreas, leading to decreased control of blood glucose levels, and a risk of developing type 2 diabetes mellitus [(10)]

Body mass index measurements aim to indicate whether a person's weight is normal, less, overweight, or even obese. Measurement of body mass index has the disadvantage that BMI does not take into account the origin of the weight whether muscle or fat. BMI does not consider waist circumference and muscle mass and BMI does not take into account the type of fat. For example, bodybuilders have a high BMI when more muscle mass than fat. People with central obesity have a normal BMI when fat accumulates in the visceral (in the stomach and internal organs). Central obesity has an excessive risk of hyperglycemia and diabetes mellitus than people who have a lot of subcutaneous fat under the skin will tend to look fat [(11)]. Central obesity is a contributing factor to insulin resistance. In people with central obesity the increased free fatty acids interfere with insulin's ability to inhibit hepatic glucose production and inhibit the supply of glucose into the skelet muscle, also inhibiting insulin secretion from pancreatic beta cells. This leads to insulin resistance. Insulin resistance is a condition when the body is no longer sensitive to insulin that regulates blood glucose levels so that there is an increase in blood glucose levels in the body [(12)]

Fasting blood glucose and HbA1c are tests to measure glucose levels in the blood. Fasting blood glucose checks require fasting (usually 8-10 hours) before the test, so that the results are not affected by the food consumed. This test is commonly used to diagnose diabetes. HbA1c is a test to measure the percentage of blood

glucose attached to hemoglobin (Hb). HbA1c examination aims to find out the average level of blood glucose in the last 2-3 months. This test is useful for controlling glucose levels of people with type 2 DM. In an effort to control blood glucose levels in DM patients, therapy known as four pillars is education, diet, physical activity or exercise, and pharmacology [13]

The limitation in the study was not identifying whether the patient was new or chronic. In people with chronic diabetes mellitus insulin is not enough to prevent the body to obtain glucose from the blood into the body cells that will be used as energy, when this happens the body begins to burn fat and muscle to become energy. This leads to a reduction in the weight of diabetic patients which causes a low body mass index.

CONCLUSION

Based on the results of the study can be concluded there is no correlation between fasting blood glucose levels and HbA1c with BMI in type 2 diabetes mellitus patients.

REFERENCES

1. Guntur. The Relationship between Gout and HbA1c in People with Type 2 Diabetes Mellitus who was Hospitalized at RSUP Prof. Dr. R.D. Kandou Manado. J e-Clinic. 2016;4(2).
2. Kemenkes RI. Infodatin: Diabetes Mellitus. Jakarta: Pusdatin Kemenkes RI; 2020.
3. Perkeni. Management and Prevention of Type 2 Diabetes Mellitus in Indonesia. Jakarta: Perkeni; 2015.
4. Charisma. Correlation of Fasting Blood Glucose Average Levels and 2 Hours Post Prondial Last Three Months With HbA1c Value in Patients with Diabetes Mellitus Prolanis BPJS Kediri Regency Period May-August 2017. J Kesehat Masy Indones. 2017;12(2).
5. Suprapto. Counseling Activities about Militus Diabetes in Barombong Village of Makassar City. J Community Serv. 2019;1(2).
6. Adnan. Relationship of Body Mass Index (BMI) with Blood Glucose Levels of People with Diabetes Mellitus (DM) Type 2 Outpatient at Tugurejo Hospital Semarang. J Nutr Univ Muhammadiyah Semarang. 2013;2(1).
7. Budiamal. Relationship of Fasting Blood Sugar And HbA1c with Body Mass Index in People with Type 2 Diabetes Mellitus. Diponegoro Med J. 2013;2(1).
8. Suryanti SD, Raras AT, Dini CY, Ciptaningsih AH. Hubungan Indeks Massa Tubuh dengan Kadar Gula Darah Puasa pada Pasien Diabetes Melitus Tipe 2. Poltekita J Ilmu Kesehat. 2020;13(2):86–90.
9. Prihaningtyas R. Obese Child. Jakarta: Elex Komputindo; 2018.
10. Maria A. 2019. Central Obesity Relationship with Fasting Blood Glucose Levels in Students of the Faculty of Medicine, University of Nusa Cendana. Sandalwood Med J. 2019;18(3).
11. Yusnita. Risk of Symptoms of Complications of Type II Diabetes Mellitus at UPTD Diabetes Center Ternate City. J MPPKI. 2021;4(1).
12. Djausal. Effect of Central Obesity as Risk Factor of Metabolic Syndrom. JMajority. 2015;4(3).
13. Irianto P. Complete Nutrition Guidelines of Families and Sportsmen. Yogyakarta: CV. Andi offset; 2017.