

The Relationship Of Obesity To Haemoglobin A1c Levels In Type 2 Diabetes Mellitus Patients Using The Government Health Insurance Program.

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Abstract

Background : The prevalence of diabetes mellitus patients tends to increase. The number of Diabetes Mellitus (DM) patients in women is higher than in men, because women have a higher increase in body mass index (BMI) than men. 80% of adults with type 2 diabetes are overweight or obese. The examination haemoglobin (HbA1c) levels aims to provide an overview of the average sugar levels for the last three months and reflect the daily blood sugar control of type 2 DM patients.

Purpose : This study aims to determine the relationship between obesity and HbA1c levels in type 2 DM Patients Using The Government Health Insurance Program.

Method : This is an observational study, using a cross sectional design with a sample size of 892. Obesity was measured using BMI (Body Mass Index) and HbA1c levels were measured by venous blood examination. Primary data are weight and height as the basis for measuring BMI, while secondary data are the results of laboratory examinations for HbA1c levels. Data analysis using Chi Square test.

Results: The results showed that 76.3% of respondents were female, 23.7% male, 10.2% of respondents were obese, 89.8% of respondents were not obese. 90.6% of women have high HbA1c levels, 88.6% of obese respondents have high HbA1c levels. The results of the analysis show that gender p value = 0.154 and obesity p value = 0.357

Conclusion: There is no relationship between obesity and gender on HbA1c levels in type 2 DM patients.

Key words : Obesity, HbA1c Level, Type 2 Diabetes Mellitus

Introduction

The Government Health Insurance Program BPJS is an institution established to administer social security programs in Indonesia according to The Law of The Republic Indonesia Number 40 Year 2004 concerning the National Social Security System and The Law of The Republic Indonesia Number 24 Year 2011 concerning The Social Security Administrative Body that the national social security system is a state program that has objective of ensuring protection and social welfare for all people. has the aim of encouraging patients with chronic diseases to achieve optimal quality of life and is expected to reduce the risk of complications from chronic diseases. (Raraswati, Heryaman and Soetedjo, 2018).

The number of diabetes mellitus (DM) patients in the world in 2019 reached 463 million people, and this number will continue to increase to 578 million people by 2030 (IDF, 2019a). There was an increase of 51%, over a period of 11 years. This increase is quite a large number, for diabetes mellitus patients in the world. Meanwhile, the number of diabetes mellitus patients in Indonesia in 2019 aged 20 to 79 years according to (IDF, 2019b) amounted to 10,681 people. This number is expected to continue to increase in 2030, which is 13,666 people (IDF, 2019b) With the increasing number of diabetes mellitus patients in Indonesia, Indonesia is ranked 7th in the world with the highest number of diabetes mellitus patients (Ladyani et al., 2020). Indonesia is also the only country in Asia that is included in the highest number of diabetes patients in the world in 2019 (Infodatin, 2020)

Diabetes mellitus is a chronic metabolic disease caused by the pancreas not producing enough insulin or the body cannot use the insulin it produces effectively (Primahuda and Sujianto, 2016). There are three types of diabetes mellitus (DM), namely type 1 DM, type 2 DM, and gestational DM. According to (ADA, 2019) type 2 DM accounts for 90% to 95% of all diabetes. Or in other words, type 2 diabetes is the type of diabetes that most people suffer from (ADA, 2019)

Type 2 diabetes mellitus is a metabolic disorder disease characterized by an increase in blood sugar due to a decrease in insulin secretion by pancreatic beta cells or impaired insulin function (Depkes in Fatimah, 2015). This is indicated by an increase in blood sugar levels in type 2 diabetes mellitus patients. This opinion is in line with (ADA in Rasdianah et al., 2016) which explains that diabetes mellitus is a group of metabolic diseases with hyperglycemic characteristics that occur due to abnormalities in insulin secretion, insulin action, or both. Chronic hyperglycemia in diabetes is associated with long-term damage and dysfunction of several organs of the body, especially the eyes, kidneys, nerves, heart, and

blood vessels, which causes various complications including atherosclerosis, neuropathy, kidney failure, and retinopathy (ADA, 2014).

The prevalence of type 2 DM in men and women is different. According to (Fatimah, 2015) the number of diabetes mellitus patients in women is higher than in men. This is because women have a higher increase in body mass index than men (Fatimah, 2015). In line with research conducted by (Primahuda and Sujianto, 2016) which stated that the most people with diabetes were women, namely 87.8% of the samples taken (Primahuda and Sujianto, 2016)

Increased obesity, lack of physical activity, consuming less fibrous foods, smoking and consumption of high-fat foods are thought to be the cause of the increase in type 2 DM patients. 80% of adults with type 2 DM are overweight or obese (Putri and Larasati, 2013). This opinion is supported by research (Betteng et al, 2014) which suggests that obesity is a factor causing type 2 diabetes mellitus (Betteng et al, 2014). The main cause of obesity is an imbalance of energy between calories consumed and calories used. The cause of the imbalance can be caused by an increase in the intake of energy foods with a high fat content and a decrease in physical activity (Dewi and Mahartini, 2019)

Type 2 DM is a chronic disease whose symptoms are difficult to identify, and can cause complications, so it is necessary to control it (Ladyani et al., 2020). There are two ways to control blood glucose in DM patients, namely by monitoring blood glucose for a moment and long-term blood glucose. Instantaneous blood glucose monitoring can be seen from fasting blood glucose and 2 hours post prandial, while long-term blood glucose control can be done by checking HbA1c (Sucitawati, Santhi and Subawa, 2019). Examination of HbA1c levels aims to provide an overview of the average sugar levels for the last three months and reflect the daily blood sugar control of DM patients (Arisandi et al., 2018). The advantages of HbA1c are that it has a better overall glucose exposure index and can assess long-term complications, is relatively unaffected by acute conditions, can be used for guidance and adjustment of therapy, can be performed while fasting or not, and is a test that can be used for diagnosis and treatment glycemic control assessor (Wulandari and Adelina, 2020). Based on the above background, the researchers wanted to examine the topic of the relationship between obesity and HbA1c levels in type 2 DM patients who use The Government Health Insurance Program facilities.

Method

Observational research with cross sectional research design. Respondents were patients with type 2 diabetes mellitus who had their HbA1c levels checked. The number of samples was 892. Data collection methods with primary data were measurements of the respondents' weight and height. HbA1c levels

were taken from secondary data from laboratory tests using an affinion tool. Univariate data analysis was carried out on gender characteristics, obesity according to BMI which was categorized into non-obese BMI < 25 and obese BMI > 25 according to the 2014 National Nutrition Guidelines and HbA1c levels which were categorized as normal, namely HbA1c levels < 6.5 and high, namely HbA1c levels > 6,5 according to Perkeni. Bivariate data analysis using Chi Square test or Fisher's exact test with SPSS 16.

Result

Table 1. Characteristics of respondents

Characteristics	Quantity	%
Gender		
Woman	681	76,3
Man	211	23,7
Body mass index		
Less	49	5,5
Normal	510	57,2
Obese	333	37,3

Table 2. Distribution of Research Variables

Variable	Quantity	%	Mean	Min-Max
Obese				
No	559	62,7	24,13	12,6 – 45,45
Yes	333	37,3		
HbA1c level				
Normal	91	10,2	8,8	5,0 – 15,0
High	801	89,8		

Based on the table of characteristics of the respondents above, according to gender, 76.3% of respondents are female, while according to the body mass index, most of the respondents are in the normal category, which is 57.2%. The average BMI in the study was 24.13 kg/m². Respondents who have normal HbA1c levels are 10.2% while respondents who have high HbA1c levels are 89.8%. The average HbA1c level in the study was 8.8 with a minimum value of 5.0 and a maximum value of 15.0.

Table 3. Relationship between Sex and Nutritional Status with HbA1c levels

Variable	HbA1c level				P value
	High		Normal		
	n	%	n	%	
Sex					
Woman	617	90,6	64	9,4	0,154*
Men	184	87,2	27	12,8	
Obese					
Yes	295	88,6	38	11,4	0,357*
No	506	90,5	53	9,5	

* Chi Square Test

Based on the table above, there are 2 independent variables, namely gender and obesity which are associated with HbA1c levels. The results of the Chi Square test analysis obtained that gender and obesity variables with p value <0.05, which means statistically there is no relationship with HbA1c levels in type 2 DM patients who use BPJS facilities.

DISCUSSION

Based on the results of the study in Table 3, most of those who had high HbA1c levels were women at 90.6% while men at 87.2%. This can happen because in women there is a higher percentage of fat deposits compared to men, causing a decrease in sensitivity to insulin action in the muscles and liver (Bintanah and Handarsari, 2012). In addition, in women there is the hormone estrogen which can affect blood glucose levels, where the body becomes resistant to insulin when the hormone estrogen increases (Putri and Larasati, 2013).

In this study, most of the respondents who had high HbA1c levels were not obese (90.5%), but one of the causes of high levels of HbA1c in the blood is obesity. Increased levels of glucose in the blood caused by obesity can interfere with the process of glucose uptake into cells (Sucitawati, Santhi and Subawa, 2019).

Relationship of Sex with HbA1c Levels.

The results of the bivariate analysis using the Chi Square test obtained p value = 0.154. The p value shows that there is no significant relationship between gender and HbA1c levels in type 2 DM patients, but most of those who have high HbA1c levels are female respondents (90.6%).

This study is in line with research conducted at DrKariadi Hospital Semarang which said there was no relationship between gender and HbA1c levels in type 2 DM patients (p = 0.414) (Fauzia, Nughroho and Margawati, 2018).

Most of the women in this study who had high HbA1c levels. This is in line with research conducted by (Ramadhan and Marrisa, 2015). Which states that the majority of DM patients at the Jayabaru Health Center, Banda Aceh City are women with HbA1C > 6.5. Likewise research conducted by (Putri, Jazil and Nugraha, 2013) which states that female DM patients are 58.3%, or more than male patients. Research conducted (Chen et al, in Ramadhan and Marrisa, 2015) stated that the results of research in Taiwan also found that the percentage of HbA1C values > 6.5 in women was 66.7% higher than men (Chen et al, in Ramadan and Marisa, 2015).

Women are more at risk of developing DM, due to a greater increase in body mass index (BMI). Monthly cycle syndrome (premenstrual syndrome), postmenopause which makes the distribution of body fat easily accumulate due to hormonal processes, causing women to be at risk of suffering from DM (Irawan in Ramadhan and Marrisa, 2015)

Relationship between obesity and HbA1c levels

The results of the bivariate analysis using the chi square test obtained p value = 0.537. The p value shows that there is no significant relationship between obesity and HbA1c levels in type 2 DM patients.

This research is in line with research conducted at the Clinical Pathology Laboratory of RSUD dr. H. Abdul Moeloek Lampung Province who said there was no relationship between obesity and HbA1c levels in type 2 DM patients (p = 1,000) (Putri and Larasati, 2013). The Research conducted at DrMohamadHusein Hospital Palembang also said that there was no significant relationship between obesity and HbA1c levels in Type 2 DM patients (p = 0.128) (Bonita, Asnawi and Aulia, 2017). Research

conducted at the Tarik Health Center in Sidoarjo Regency said that there was no relationship between obesity and HbA1c levels in DM patients ($p = 0.429$) (Wulandari and Adelina, 2020). However, this study is not in accordance with Perkeni which states that obesity is a risk factor for type 2 DM (PERKENI, 2015).

This can be due to other factors such as central obesity, where central obesity as measured by waist circumference is more sensitive in predicting metabolic disorders because it is associated with an increase in the amount of body fat that causes insulin resistance. BMI to measure obesity is not very sensitive in describing metabolic disorders that occur (Putri and Larasati, 2013). Respondents who have high HBA1C levels but are not obese are DM patients who experience continuous weight loss for no apparent reason from the beginning being diagnosed with type 2 DM, so that when the BMI examination is carried out there is a change.

Conclusion :

There was no significant relationship between gender and HbA1c levels in type 2 DM patients. HbA1c levels in women are more than men because women have a higher percentage of fat deposits compared to men, causing a decrease in sensitivity to insulin action in the muscles and liver and the hormone estrogen which can affect blood glucose levels, where the body becomes resistant. to insulin when the hormone estrogen. Obesity in type 2 DM patients had no significant relationship with HbA1c levels. This can be due to other factors such as central obesity, where central obesity as measured by waist circumference is more sensitive in predicting metabolic disorders because it is associated with an increase in the amount of body fat that causes insulin resistance. BMI to measure obesity is not very sensitive in describing metabolic disorders that occur. There is no significant relationship between gender and obesity with HbA1c levels in Type 2 Diabetes Mellitus patients who use The Government Health Insurance Program facilities.

References

- ADA (2014) 'Standards of medical care in diabetes-2014', Diabetes Care, 37. doi: 10.2337/dc14-S014.
- ADA (2019) '2. Classification and diagnosis of diabetes: Standards of medical care in diabetes 2019', Diabetes Care, 42, pp. S13–S28. doi: 10.2337/dc19-S002.
- Arisandi, R. et al. (2018) 'Relationship of HbA1c Levels with the Incidence of Diabetic Retinopathy in

Type 2 Diabetes Mellitus Patients Following Prolanis at the Kedaton Public Health Center, Bandar Lampung City', Majority, 7(3), pp. 17–23.

Betteng, R. (2014) 'Analysis of Risk Factors Causing Type 2 Diabetes Mellitus in Women of Productive Age at Wawonasa Public Health Center', Jurnal e-Biomedik, 2(2). doi: 10.35790/ebm.2.2.2014.4554.

Bintanah, S. and Handarsari, E. (2012) 'Fiber Intake with Blood Sugar Levels, Total Cholesterol Levels and Nutritional Status in Type 2 Diabetes Mellitus Patients at Roemani Hospital Semarang', Seminar on Research Results, LPPM UNIMUS.

Bonita, B., Asnawi, H. and Aulia, H. (2017) 'The Relationship of Physical Activity, Sleep Quality, and Body Mass Index with HbA1c Levels in Type 2 DM Patients who Come to the Diabetic Metabolic Endocrine Polyclinic at RSUP DR. Mohammad Hoesin Palembang', Biomedical Journal of Indonesia, 3(1).

Dewi, D. Y. and Mahartini, N. N. (2019) 'The relationship between body mass index and fasting blood sugar levels of visitors to the Niti Mandala Renon field in July 2018', 10(3), pp. 711–714. doi: 10.15562/ism.v10i3.503.

Fatimah, R. N. (2015) 'Diabetes Melitus Tipe 2', Indonesian Journal of Pharmacy, 4(5), pp. 93–101. doi: 10.14499/indonesianjpharm27iss2pp74.

Fauzia, H. A., Nughroho, H. and Margawati, A. (2018) 'The Relationship between Knowledge Levels and Behavioral Aspects with Glycemic Control Status of Diabetes Mellitus Patients at RSUP Dr. Kariadi', Diponegoro Medical Journal, 7(2).

IDF (2019a) 'Global Diabetes Data Report 2010-2045', Journal IDF, 9(9), p. 1.

IDF (2019b) 'Indonesia-diabetes-report.pdf'.

Infodatin (2020) 'Pusat dan Informasi Kementrian Kesehatan RI'.

- Ladyani, F. et al. (2020) 'Compliance with BPJS Prolanis with HbA1c Examination Results in Diabetes Mellitus Patients', *Health Scientific Journal Sandi Husada*, 11(1), pp. 292–297. doi: 10.35816/jiskh.v11i1.267.
- Marrisa, N. R. ; N. (2015) 'Characteristics of Type 2 Diabetes Mellitus Patients Based on Hba1C Levels at Jayabaru Health Center Banda Aceh City', *Journal of Rheumatology*, 2(2), pp. 49–56.
- PERKENI (2015) *Management and Prevention of Type 2 Diabetes Mellitus in Indonesia 2015*.
- Primahuda, A. and Sujianto, U. (2016) 'The Relationship Between Compliance with BPJS Chronic Disease Management Program (PROLANIS) and Blood Sugar Stability in Diabetes Mellitus Patients at Babat Health Center, Lamongan Regency', *Nursing Majoring*, pp. 1–8.
- Putri, A. E. S. and Larasati, T. (2013) 'The Relationship of Obesity with HbA1c Levels in Type 2 Diabetes Mellitus Patients at the Clinical Pathology Laboratory of the Abdul Moeloek Regional General Hospital, Lampung Province', *Medical Journal of Lampung University*, 2(4).
- Putri, L., Karimi, J. and Nugraha, D. P. (2013) 'Description of the Use of Anti-Diabetes Drugs and Knowledge of Type 2 Diabetes Mellitus Patients at the Internal Medicine Polyclinic of Arifin Achmad Hospital Pekanbaru', *Faculty of Medicine, Riau University*, pp. 1–9.
- Raraswati, A., Heryaman, H. and Soetedjo, N. N. M. (2018) 'The Role of the Prolanis Program in Reducing Fasting Blood Sugar Levels in Type 2 Diabetes Mellitus Patients at the Jatinangor District Health Center', *Journal of Science and Health*, 4(2).
- Rasdianah, N. et al. (2016) 'The Description of Medication Adherence for Patients of Diabetes Mellitus Type 2 in Public Health Center Yogyakarta', *Indonesian Journal of Clinical Pharmacy*, 5(4), pp. 249–257. doi: 10.15416/ijcp.2016.5.4.249.

Sucitawati, P. D., Santhi, D. D. and Subawa, A. N. (2019) 'Relationship between Central Obesity and Hba1c Levels in Population Aged 30-50 Years in the Batusari Environment, Bitara Village, Gianyar', *Intisari Sains Medis*, 10(3), pp. 766–771. doi: 10.15562/ism.v10i3.451.

Wen Chen, K.- and Tseng, H.-M. (2012) 'The Barriers to Initiating Insulin Therapy among People with Type 2 Diabetes in Taiwan - A Qualitative Study', *Journal of Diabetes & Metabolism*, 03(05), pp. 3–6. doi: 10.4172/2155-6156.1000194.

Widada, T. (2017) 'The Role of the Health Social Security Administering Body (BPJS) and Its Implications for Community Resilience (Study at Hasanuddin Damrah Manna Hospital, Bengkulu Regency', *National Resilience Journal*, 23(2).

Wulandari, D. S. and Adelina, R. (2020) 'Relationship of Anthropometric Status with Blood Glucose Levels, HbA1c Levels and Diet in Type 2 Diabetes Mellitus Patients at Tarik Health Center, Sidoarjo Regency', *Nutritional Food Media*, 27(1), pp. 167–178.