ORIGINAL ARTICLE

Correlation between Physical Activity and Fasting Blood Glucose in Patient with Type 2 Diabetes Mellitus

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A B S T R A C T

Introduction: Diabetes Mellitus is a disease caused by an increase in blood glucose levels, which is an increase in levels at an abnormal level, or called hyperglycemia. Diabetes is a metabolic disease related to various factors such as physical activity, lifestyle, habits, diet, etc. Diabetes mellitus is classified as type 1 diabetes mellitus, type 2 diabetes mellitus, and gestational diabetes. Type 2 Diabetes Mellitus (T2DM) is caused by the body's inability to use insulin effectively (insulin resistance). This study aims to determine the relationship between physical activity and fasting blood glucose levels of T2DM patients to provide social change by increasing physical activity to control fasting blood glucose in patients with T2DM.

Methods: This study is quantitative research of analytic observation with a cross-sectional design. The sample in this study was the outpatient T2DM at Endocrine Unit RSUD Dr Soetomo Surabaya from June until September 2018 consecutive sampling. The independent variable was physical activity, and the dependent variable was fasting blood glucose (FBG). Methods of collecting primary data by interview using IPAQ (International Physical Activity Questionnaire) and secondary data by looking at the results of FBG from the patient's medical records of laboratory tests. Collected data were entered into Microsoft excel and then statistically analyzed using IBM SPSS 22. Spearman's Rho Correlation Test analyzed the data.

Results: Sixty three respondents became in inclusion criteria. Most patients have a moderate physical activity of 28 people, or around 44.4%. Thirty-two people had poor fasting blood glucose levels of about 50.8%. The analysis result was there is a significant correlation between physical activity and fasting blood glucose levels of T2DM patients and a low correlation coefficient in the opposite direction (not in the same order).

Conclusion: Physical activity impacts fasting blood glucose levels and has a negatively correlated direction. The increase in physical activity showed by the value of the IPAQ score, followed by a decrease in fasting blood glucose level.

Keywords: Fasting blood glucose, Physical activity, Type 2 diabetes mellitus

INTRODUCTION

Diabetes Mellitus is a disease caused by increased blood glucose levels at abnormal limits or hyperglycemia. This disease is not contagious but can be related to various factors such as physical activity, lifestyle, habits, eating patterns, etc. Diabetes mellitus is classified as type 1 diabetes mellitus, type 2 diabetes mellitus, and gestational diabetes. This disease is caused by the body's unable to use insulin effectively (insulin resistance). Type 2 Diabetes Mellitus (DMT2) cannot be cured; controlling blood glucose levels can help reduce the risk of complications (American Diabetes Association, 2021). The Basic Health Research Survey conducted by the Indonesian Ministry of Health in 2013 found that the prevalence of diabetes in Indonesia was around 6.9%, impaired glucose tolerance was about 29.9% and impaired fasting blood glucose was 36.6 % of the population over 15 years old (Ministry of Health of the Republic of Indonesia, 2013).

Diabetes, especially T2DM, can be caused due to various risk factors, such as an unhealthy lifestyle, certain food consumption habits, sleep patterns errors, lack of physical activity, etc. Whereas clinically, people with DMT2 can find several problems such as weight, blood pressure, blood glucose levels, metabolic disorders, and so on (Gillett et al., 2012). Still, the incidence of T2DM remains high due to each person's habits and various other factors such as heredity and unhealthy lifestyle. The government has implemented several programs for handling T2DM, such as Posbindu PTM (Integrated Non-communicable Disease Development Post). This study aims to determine the relationship of physical activity with fasting blood glucose levels in patients with type 2 diabetes mellitus to provide social change by increasing physical activity to control fasting blood glucose in patients with type 2 diabetes mellitus.

METHODS

This study is quantitative research of analytic observation with a cross-sectional design. The sample in this study was the outpatient T2DM at Endocrine Unit RSUD Dr Soetomo Surabaya from June until September 2018 consecutive sampling. The inclusion criteria were a type 2 diabetes mellitus outpatient from RSUD Dr Soetomo, who was regularly in treatment, already fasting blood glucose level examination when the study was conducted and a maximum of one month ago, and who was willing to be research subjects. The exclusion criteria were women who are pregnant, paralyzed patients, and a patient who have malignancy.

The independent variable was physical activity, and the dependent variable was fasting blood glucose (FBG). Methods of collecting primary data by interview using IPAQ (International Physical Activity Questionnaire) then it was classified into low (<600 MET- minute/week), moderate (600-3000 MET-minute/week), and high (>3000 MET-minute/week) physical activity and secondary data by looking at the results of FBG from the patient's medical records of the latest laboratory test in the same month of research at RSUD Dr. Soetomo which distinguished by good (80-100 mg/dL), medium (101-125 mg/dL), and bad ($\geq$ 126 md/dL). Collected data were entered into Microsoft excel and then statistically analyzed using IBM SPSS 22. Spearman's Rho Correlation Test analyzed the data. Data collected in this research were name, age, gender, physical activity score or level, and fasting blood glucose level.

RESULTS

Table 1. Characteristics of Respondents in Tambakrejo Primary Health Care in August – December 2017

Characteristics	Total N = 63	N (%)
Age		
Late Adults (36-45)	4	6.3
Early Elderly (46-55)	22	34.9
Late Elderly (56-65)	27	42.9
Senior (>65)	10	15.9
Sex		
Male	23	36.5
Female	40	63.5
Physical Activity		
Low	11	17.5
Medium	28	44.4
High	24	38.1
Fasting Glucose Blood		
Good Control	11	17.5
Medium Control	20	31.7
Bad Control	32	50.8

The characteristics of respondents are presented in Table 1, consisting of age, sex, physical activity, and fasting blood glucose levels. Based on age, there are four people in late adults, 27 people in early elderly, 24 people in late elderly, and ten seniors, the youngest subject obtained is 40

years old while the oldest is 75 years old. There are more female subjects than male subjects, the women as many as 40 people, men as many as 23 people. Based on physical activity, 12 people have low activity, 28 have medium activity, and 24 have high activity. Most of the subject's blood glucose levels were above 126 mg/dL, and as many as 32 subjects indicated bad control conditions.

Table 2. Spearman Rho Test's Result

Independent Variable	Dependent Variable	Correlation Coefficient (R)	P-value
Physical Activity	Fasting Blood Glucose	-0.306	0.015

P-value measures the probability of obtaining the observed results, assuming that the null hypothesis is true.

Table 2 shows the result of physical activity dan fasting blood glucose analysis. The p-value is 0.015, meaning there is a significant correlation between physical activity and fasting blood glucose level.

DISCUSSION

In this study, it was found that most diabetics were dominated by people from the age of the early elderly to the late elderly, around the age of 46 to 65 years. This follows the research conducted in Magelang, which also shows that T2DM patients are dominated by people over 45 years old (Rachmawati & Dyan, 2015). In Table 1, it was also found that most of the subjects were female, where women occupied 63.5% (40 people) while men occupied 36.5% (23 people). Still, different results were found in cohort studies in which, in Thailand, the incidence of T2DM was more significant in men (249/10000) than in women (119/10000) (Papier et al., 2016). This can be caused by the fact that men have more potential to have more visceral and central fat distribution. Some studies say that visceral and central fat distribution can be a determinant of DMT2 risk factors rather than a person's body mass index, where people who have a higher body mass index lower likelihood of suffering from DMT2 compared to those with a high body mass index with more visceral and central fat distribution, this is what makes it possible to find more female T2DM patients and fasting blood glucose levels in male patients higher than female patients (Nordstrom et al., 2016). The study's results on physical activity found that most diabetic patients had a moderate physical activity of 44.4%. The same results were obtained in studies conducted on T2DM patients in Karanganyar Hospital, where 89.8% of subjects had moderate physical activity classified as IPAQ. 6 In table 1, it was also found that the majority of subjects had poor fasting blood glucose control of 50.8% (32 people) who had fasting blood glucose levels above 126 mg / dL (7 mmol / L). Various studies have shown that lifestyle and unhealthy habits are essential factors in the causes of poor glycemic control in T2DM patients (Rajeshwar et al., 2016). The patient's disobedience to diet and therapy given by doctors is also another essential factor (Sanal et al., 2011).

Based on the test between the two variables, a significance value of p = 0.015 (p <0.05). This shows a significant relationship between physical activity seen from the classification of the IPAQ score (International Physical Activity Questionnaire) with fasting blood glucose levels. The value of the correlation coefficient (r) the value is

-0.306, which indicates a negative correlation with weak strength. This correlation means that the relationship is in the opposite direction, namely the increasing value of the physical activity. Hence, the fasting blood glucose level decreases, and vice versa, the decreasing physical activity increases the fasting blood glucose level. Similar to the research conducted on T2DM patients in Karanganyar Hospital, where there is a relationship between physical activity and fasting blood glucose levels, evidenced by the value p = 0.001, which shows a significant relationship, and r = -0.433, which indicates the association has the opposite direction, in patients with high physical activity having fasting blood glucose which tends to be low.

In the Canadian Journal of Diabetes, physical activity is one of the keys to the management of diabetes mellitus, primarily as a blood glucose controller and improving cardiovascular risk factors such as reducing hyperinsulinemia, increasing insulin sensitivity, reducing body fat, and reducing blood pressure (Plotnikoff et al., 2006). In contrast, patients with low physical activity have high fasting blood glucose levels (Mayawati & Isnaeni, 2017). The same results were also found in the study conducted on T2DM patients in Mulyorejo Health Center Surabaya, where there was a significant relationship between physical activity and fasting blood glucose levels in subjects who had low physical activity also had high fasting blood glucose levels, which meant physical activity had the relationship with fasting blood glucose levels was proven by the value p = 0.01 (Nurayati & Adriani, 2017). The limitation of this study is that the sample size was too small, so it could not represent the actual result for gender.

CONCLUSION

Physical activity has an impact on controlling fasting blood glucose levels and has a negatively correlated direction. The increase in physical activity showed by the value of the IPAQ score, followed by a decrease in fasting blood glucose level. It suggested that patients improve physical activity by regular exercise, maintaining a diet, and applying a healthy lifestyle to control fasting blood glucose levels.

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CONFLICT OF INTEREST

The authors declare there is no conflict of interest.

ETHICS CONSIDERATION

This research was ethically cleared and approved by Ethical Committee for Health Research of Dr Soetomo General Academic Hospital certificate no.0247/KEPK/IV/2018.

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AUTHOR CONTRIBUTION

All authors have contributed to all process in this research, including preparation, data gathering and analysis, drafting and approval for publication of this manuscript.

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