Original Research/Systematic Review

The Relationship Between Age, Dietary Patterns, and Physical Activity with the Incidence of Type 2 Diabetes Mellitus

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ABSTRACT

Background: *Indonesia ranks sixth internationally in diabetes cases, with 19.5 million cases in 2021, projected to increase to 28.6 million cases by 2045. The risk factors for diabetes mellitus consist of modifiable and non-modifiable factors. Modifiable risk factors include obesity, high blood pressure, and smoking habits. Non-modifiable risk factors include age, gender, and a family history of diabetes mellitus. Diabetes mellitus risk factors are divided into modifiable and non-modifiable factors.*

Methods: *This study uses a non-experimental method, namely research without intervening on respondents and by means of a case control method. The statistical test used to determine the relationship between variables in this study is the Chi-Square test.*

Results: *The results of the study showed that there was a relationship between age and the incidence of type 2 diabetes mellitus with a p-value of 0.022. Then there was a relationship between diet and the incidence of type 2 diabetes mellitus with a p-value of <0.001 and there was a relationship between physical activity and the incidence of type 2 diabetes mellitus with a p-value of 0.044*

Conclusion: *It is recommended that research be conducted more extensively, that the community maintain a healthy lifestyle, and that institutions support research and education.*

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INTRODUCTION

Hyperglycemia, which can be caused by changes in insulin action, secretion, or both, is a sign of a metabolic disease known as diabetes mellitus. Hyperglycemia is a medical condition associated with many diseases, including diabetes mellitus. (Perkeni, 2019, in Marcelline *et al*., 2021). There are four forms of diabetes mellitus: type 1 DM, type 2 DM, other types of DM, and Gestational DM. 90-95% of diabetic patients suffer from type 2 DM, which results in decreased insulin production or insulin resistance, or decreased sensitivity to insulin.

According to the Ministry of Health (2022) At the end of 2021, diabetes cases were confirmed by the International Diabetes Federation (IDF) in the 10th edition of the Atlas

as one of the global health problems of the 21st century with the fastest growth rate. More than half a billion people worldwide, or 537 million people, had diabetes in 2021. When compared to other ASEAN members, Indonesia ranks highest according to this metric. Meanwhile, Indonesia ranks sixth internationally in terms of diabetes cases, with 19.5 million cases in 2021 and is estimated to increase to 28.6 million cases by 2045 (Riskesdas, 2018).

The Special Capital Region (DKI) of Jakarta is the province in Indonesia with the highest prevalence of diabetes mellitus. Based on Riskesdas 2013 statistics, the prevalence of DM has increased in the last five years, from 2.5% in 2013 to 3.4% in 2018. There are 10.5 million people or around 250 thousand residents in DKI Jakarta who suffer from DM. In DKI Jakarta, East Jakarta has the second highest percentage of DM sufferers. DM continues to rank second in the summary of non-communicable disease visits in East Jakarta with a total of 57,190 visits, according to the report of the first and second quarters of the East Jakarta Administrative City Health Office Tribe Program in 2021. (East Jakarta Health Department, 2021).

One of the factors that contribute to the occurrence of diabetes mellitus is age. Many people with type 2 diabetes mellitus are over 45 years old because as they age, the number of β cells that are able to function optimally decreases (Saroh *et al*, 2019 in Rohmatullah *et al*, 2024). Several factors that affect the increase in blood glucose such as stress, genetics, alcohol consumption, smoking, coffee and caffeine consumption. In getting controlled blood glucose, it is mandatory to regulate a healthy diet every day, fulfilling the nutritional content according to the needs of the body. In addition, it is necessary to regulate physical activity on a daily basis to maintain blood glucose (Amelia *et al*, 2015). Physical activity is a preventive factor in DM disease, every movement of the body needs to expend more energy than in a resting state, these movements aim to improve health in the body (Sunarti, 2018).

Based on research conducted by Rohmatullah (2024), the incidence of type 2 diabetes mellitus at Karsa Husada Hospital is not much related to the age or gender of the sufferer, this can be determined. According to the research conducted at Karsa Husada Hospital, age is not the main factor that contributes to the increase in the incidence of type 2 diabetes. Based on the results of research and discussion (Amirah et al, 2022), it can be concluded that there is a significant relationship between diet, especially in terms of adequate energy, carbohydrates, and fat, and the incidence of diabetes mellitus in people aged >40 years in Batangkaluku Village, Gowa Regency. This is indicated by the value of p = 0.00, which is smaller than the value of α (0.05).

Based on research conducted by Balyan, et al (2023) on 244 respondents (100%) in the Lhokseumawe Health Office Work Area consisting of 7 Health Centers, namely Mon Geudong Health Center, Bandar Sakti Health Center, Muara Satu Health Center, Muara Dua Health Center, Blang Mangat Health Center, Blang Cut Health Center and Sometimes Health Center, it can be found that of the 73 (100%) respondents who have light physical activity in the quality of life, the majority are moderate, 45 (61.6%), Of the 127 (100%) who had moderate physical activity in the quality of life, the majority (38.6%) were overweight, 49 respondents, with a P value of 0.000 < 0.05, which means that there is a relationship between physical activity and the quality of life of patients with diabetes mellitus.

MATERIALS AND METHOD

This study uses a non-experimental method, namely research without intervention on respondents and by means of the case control method. The sample in this study amounted to 70 respondents consisting of 35 case groups and 35 control groups. The instruments in this study are, medical records to find out the respondent's GDS examination history, demographic questionnaire to find out the patient's identity, FFQ (Food Frequency Quistionnaire) questionnaire to measure the respondent's diet and using the GPAQ (Global Physically Activity Quistionnaire) questionnaire to measure the respondent's physical activity. The statistical test used to determine the relationship between variables in this study is the Chi-Square test.

RESULTS

Data obtained from 70 samples, namely poly NCD patients at the Ciracas District Health Center, showed the following results:

Table 1. Frequency Distribution by Gender

Gender	Sum	Percentage (%)
Woman	53	75,7
Man	17	24,3
Total	**70**	**100,0**

Based on table 1, the majority of respondents in this study are women, with a total of 53 people or 75.7% of the total sample.

Table 2. Frequency Distribution by Age

Age	Sum	Percentage (%)
<50 Years	11	15.7
≥50 Years	59	84.3
Total	**70**	**100,0**

Based on table 2, most of the respondents in this study are the elderly age group (≥50 years), which dominates the study population.

Table 3. Frequency Distribution by Education Level

Education	Sum	Percentage (%)
No School	2	2,9
Elementary School Equivalent	10	14,3
Junior High School Equivalent	15	21,4
High School Equivalent	30	42,9
College	13	18,6

Overall, the majority of respondents have secondary education levels (junior high school and high school equivalent) to tertiary education, with a cumulative percentage of 81.4%. This shows that the sample of this study is dominated by individuals with a fairly good formal education background.

Table 4. Frequency Distribution by Incidence of Type 2 Diabetes Mellitus

DM Incident	Sum	Percentage (%)
Case Group (Diabetes)	35	50.0
Control Group (Non-Diabetes)	35	50.0
Total	**70**	**100,0**

Based on the distribution table of the incidence of diabetes mellitus, the same proportion between the diabetic and non-diabetic groups shows that the sample of this study is evenly divided in both categories.

Table 5. Frequency Distribution by Body Mass Index (BMI) Category

Category: IMT	Sum	Percentage (%)
IMT 18,5-22,9	17	24.3
IMT 23-24,9	18	25.7
IMT 25-29,9	33	47.1
IMT >30	2	2.9
Total	**70**	**100,0**

Cumulatively, as many as 50% of respondents had BMI above normal weight (overweight and obesity). This indicates that almost half of the respondents are at a higher risk level of health problems related to overweight and obesity.

Table 6. Age Relationship with the Incidence of Type 2 Diabetes Mellitus at the Ciracas District Health Center

Age	Diabetes		No Diabetes		P-Value	OR (95% CI)
	n	%	n	%		
<50 Years	9	25,7	33	94,3		
≥50 Years	26	74,3	2	5,7	**0,022**	**0,175**
Total	**35**	**100,0**	**35**	**100,0**		

The results of the analysis showed that there was a significant relationship between age and the incidence of type 2 diabetes mellitus, with a value of $p = 0.022$ ($p < 0.05$). An Odds Ratio (OR) value of 0.175 indicates that older individuals (≥50 years) have a higher risk of developing type 2 diabetes mellitus compared to younger individuals (<50 years).

Table 7. Relationship between Diet and the Incidence of Type 2 Diabetes Mellitus at the Ciracas District Health Center

Diet	Diabetes		No Diabetes		P-Value	OR (95% CI)
	n	%	n	%		
Healthy	0	0,0	35	100,0		
Unhealthy	35	100,0	0	0,0	**<0,001**	**0,000**
Total	**35**	**100,0**	**35**	**100,0**		

The results of the analysis showed a p value of <0.001 ($p < 0.05$), which indicated that there was a significant relationship between diet and the incidence of type 2 diabetes mellitus in respondents at the Ciracas District Health Center.

Table 8. The Relationship between Physical Activity and the Incidence of Type 2 Diabetes Mellitus at the Ciracas District Health Center

Physical Activity	Diabetes		No Diabetes		P-Value
	n	%	N	%	
Low	18	51,4	8	22,9	
Keep	11	31,4	19	63,3	
Tall	6	17,1	8	22,0	**0,044**
Total	**35**	**100,0**	**35**	**100,0**	

Based on the results of the Chi-Square test carried out, there was a significant relationship between physical activity and the incidence of type 2 diabetes mellitus at the Ciracas District Health Center, with a p-value of 0.044.

DISCUSSION

Based on this study, it can be seen that in the case group, there are more respondents aged ≥50 years as many as 26 people (81.8%) and respondents who are <50 years old as many as 9 people (18.2%). In the control group, more respondents were ≥50 years old, namely 33 people (81.8%) and those who were <50 years old as many as 2 people (18.2%). The results of the analysis showed that there was a relationship between age and the incidence of type 2 diabetes mellitus, which was supported by the results of the chi square test, which obtained a value of p= 0.022 (p>0.05) which means that Ha was accepted and Ho was rejected which stated that there was a relationship between age and the incidence of type 2 diabetes mellitus. This study is in line with research conducted by Susilawati and Rahmawati (2021) that there is a relationship between age and the incidence of type 2 diabetes mellitus, obtaining a p-value = 0.000 p< (0.05). This research is also in line with research conducted by Susanti et al (2024) that there is a relationship between age and the incidence of type 2 diabetes. The proportion of people with Type 2 DM is about 25% for age (30-44 years), about 35.6% for age (45-59 years), and about 48.1% for age (60-69 years) with a proven value (p value = 0.001). However, this study is not in line with the research conducted by Nugrahaeni et al (2023) that the p-value = 0.46 was obtained, which means that there is no relationship between age and the incidence of type 2 diabetes mellitus.

The results showed that as many as 31 respondents (91.2%) in the case group had an unhealthy diet, and only 4 respondents (8.8%) had a healthy diet. Meanwhile, in the control group, as many as 32 respondents (88.9%) had a healthy diet, and as many as 3 respondents (11.1%) had an unhealthy diet. Based on the analysis test using the Chi-Square test, the value of p-value = <0.001, p<0.05 was obtained. This means that there is a relationship between diet and the incidence of type 2 diabetes mellitus at the Ciracas District Health Center. This study is in line with that conducted by Rossa (2023) that there is a relationship between diet and the incidence of type 2 diabetes mellitus, with a value of P-value = 0.000 <α 0.05 which shows that there is a significant relationship between diet and the incidence of diabetes mellitus in adulthood and a risk of 0.636 times of developing diabetes mellitus for respondents who have a bad diet compared to respondents who have a good diet. However, this study is not in line with the research conducted by Mirna et al (2020) that there was no relationship between diet and the incidence of diabetes mellitus, with a p-value = 0.109 p>0.05.

The results of this study showed that, in the case group, the majority of respondents had a low level of physical activity, namely 18 respondents (51.4%), followed by a moderate level of physical activity as many as 11 respondents (31.4%), and a low level of activity as many as 6 respondents (17.1%). Then in the control group, the majority of respondents had a moderate level of physical activity, which was 19 respondents (54.3%), then at high and low activity levels had the same number of respondents, namely 8 respondents (22.9%). In the analysis test using the Chi-Square test, P-value = 0.044, which means a value of p<0.05, and it can be concluded that there is a relationship between physical activity and the incidence of type 2 diabetes mellitus. This study is in line with what was conducted by Balyan et al (2023) that there was a relationship between physical activity and the incidence of type 2 diabetes mellitus, and a p-value = 0.000 was obtained. However, this study is not in line with the research conducted by Lestari (2021), that there is no relationship between physical activity and the incidence of diabetes mellitus with a value of p-value = 0.195, p>0.05, which means that there is no relationship between physical activity and the incidence of diabetes mellitus.

CONCLUSION

There is a significant relationship between age, diet and physical activity with the incidence of type 2 diabetes mellitus.

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