



## Analysis of Risk Factors for the Incidence of Diabetes Melitus in Kedaton, Cirebon, West Java, Indonesia

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KEYWORDS	ABSTRACT
Age, family history of diabetes mellitus, socioeconomic, education level, diabetes mellitus	DM, or diabetes mellitus, is a chronic illness that is rather common in Indonesia. Understanding the risk factors for diabetes mellitus might help improve management schemes for diabetes mellitus patients. To identify the variables that increase the risk of diabetes mellitus in the Kedaton Health Center region, a cross-sectional study was carried out at the Kedaton Health Center in Cirebon Regency in June 2024. Patients who visited the Kedaton Health Center for treatment served as the research subjects, with a total sample size of 158 respondents. Consecutive sampling was the method employed. Data were gathered using a blood glucose test and a questionnaire. Logistic regression and the chi-square test were employed for data analysis. Age ( $P = 0.001$ , $OR = 6.98$ ; 95% $CI = 2.46-19.79$ ), family history of diabetes ( $P = 0.001$ , $OR = 0.058$ ; 95% $CI = 0.019-0.184$ ), diet ( $P = 0.007$ , $OR = 0.337$ ; 95% $CI = 0.152-0.748$ ), socioeconomic status ( $P = 0.019$ , $OR = 3.557$ ; 95% $CI = 1.237-10.225$ ), and education level ( $P = 0.822$ , $OR = 0.757$ ; 95% $CI = 0.067-8.575$ ) were found to be significantly associated with diabetes mellitus. In this investigation, the incidence of DM was not correlated with gender, weight, or physical activity. A number of factors, including age, diet, family history of diabetes, socioeconomic status, and education level, significantly impact the incidence of diabetes mellitus. Age is the most significant risk factor.

### INTRODUCTION

Diabetes mellitus (DM), a chronic metabolic disease brought on by insufficient insulin synthesis, insufficient insulin action, or both, is typified by elevated blood glucose levels. In adults, type 2 diabetes is the most prevalent form of the illness and is triggered by insulin resistance and low insulin production (Rahmawati et al., 2023). Damage to the pancreatic  $\beta$ -cells leads to little or no insulin production, which causes type 1 diabetes (Rahmawati et al., 2023). Diabetes mellitus can be diagnosed if a blood glucose test results in more than 200 mg/dL accompanied by classic symptoms (Baynes, 2015; Hajam et al., 2022). Two of the three main signs of diabetes mellitus are polyuria (frequent urination), polydipsia (frequent drinking), and polyphagia (frequent eating) (Baynest, 2015; Gregory, 2023; Razaq et al., 2020).

536.6 million people worldwide were diagnosed with diabetes mellitus in 2021 (Damtie et al., 2023; Sun et al., 2022; Zerihun et al., 2024). According to IDF 2021, 19.5 million people between the ages of 20-79 years in Indonesia have diabetes mellitus, making it the nation where the prevalence of diabetes is highest worldwide (Rahmawati et al., 2023). According to the 2018 Riskesdas findings, West Java has a lower prevalence of diabetes mellitus, 1.74%, than the national average of 2% (Kementerian Kesehatan RI, 2020). Of the 275,736 people with diabetes mellitus, 42.77% reached health services and received treatment as needed (Dinas Kesehatan Jawa Barat, 2022). Cirebon district has 22,465 people with diabetes mellitus, based on the incidence of the disease in West Java province. In other words, the percentage of people with diabetes mellitus receiving health services is 83.9%, up from 78.9% of the expected number of patients in 2020 (Dinas Kesehatan Kabupaten Cirebon, 2020). In contrast, in 2023, at Kedaton Public Health Center, there were 268 people with diabetes mellitus. In the list of

the top ten diseases at the Kedaton Health Center, diabetes mellitus ranked fourth in 2023.

DM research has been carried out, but the results are inconsistent. Research by Dwi Rahayu Rediningsih and Ita Puji Lestari (2022) shows that obesity and gender have no significant effect on the incidence of diabetes mellitus (Rediningsih & Lestari, 2022), while research by Tias Tri Nurbaiti, Arrum Firda Ayu Maqfiroch, and Siwi Pramata Mars Wijayanti (2020) shows that physical activity and diet have a significant effect on the incidence of DM (Nurbaiti et al., 2020). Researchers are interested in examining the risk factors for diabetes mellitus (DM) in the Kedaton Health Center working area, Cirebon Regency, including age, family history of DM, education level, and diet. This is because the results of previous studies show that DM disease is increasingly found in rural areas, especially the service area of the Kedaton Public Health Centre.

Therefore, this study aims to identify the main risk factors related to the incidence of DM in the working area of the Kedaton Health Center, Cirebon, with a focus on age, family history of DM, education level, diet, and socioeconomic status. The novelty of this study lies in a multivariate analysis approach that investigates the interaction of several risk factors at once in a specific population setting in a semi-urban area of West Java, which is still limited in the previous literature. The benefits of this research are to provide scientific evidence that can support DM prevention and management programs at the health center level, as well as to be a consideration for policymakers in developing more targeted and effective health interventions.

## **METHOD**

This study used a cross sectional design and was observational analytic in nature which means that it only makes observations without providing interventions and examines the influence between age, family history of DM, diet, education level with the incidence of diabetes mellitus at the Kedaton Health Center, Cirebon Regency. All respondents who came to the Kedaton Health Center, Cirebon Regency, Indonesia, with a prevalence of 158 respondents were selected because they had a high incidence of diabetes mellitus compared to the incidence of diabetes mellitus in other district health centers. The Swadaya Gunung Jati University Faculty of Medicine's Ethics Committee gave this project ethical approval with no. 56/SK/FKUGJ/V/2024.

This study was conducted in June-July 2024 at the Kedaton Health Center, Cirebon Regency, West Java. The sampling technique used was the consecutive sampling method, namely the sampling method applied in this study was all samples received and met the inclusion and exclusion criteria until the required sample size was obtained. the population of this study were all respondents who came to the Kedaton Health Center, Cirebon Regency as many as 158 respondents. Sample inclusion criteria are patients who get services at the Kedaton Health Center, can communicate well, and are willing to take part in the survey. The sample exclusion criteria are diabetes mellitus patients who smoke and hypertension.

Data were obtained using a questionnaire distributed to respondents who met the criteria. Data collection was based on respondents' answers to the questionnaire and respondents' blood sugar levels with GDS and included in nominal and ordinal scales. Age was categorized into 18-45 years, 46-59 years, 60-65 years, family history of DM was categorized into history and no history, food frequency was categorized into high carbohydrate and not high carbohydrate, the last level of education was categorized into elementary school, junior high school, high school, academy / college. Diabetes mellitus using the GDS measurement method was categorized as diabetes mellitus and non-diabetes mellitus.

Respondent data were collected after obtaining ethical approval from the research ethics committee, primary data were collected using standardized questionnaires, namely GPAQ and SQ-FFQ to participating respondents to see the characteristics of the study and secondary data were taken using GDS to determine blood sugar levels.

Univariate analysis was used to obtain an overview of the frequency distribution and percentage of each research variable. The data analysis used was bivariate analysis to determine the relationship between the independent and dependent variables. The chi-square test with a significant value of  $P < 0.05$ . Multivariate analysis aimed to see the most influential risk factors. Logistic regression test was used to present data with narrative analysis and distribution table.

## RESULTS AND DISCUSSION

**Table 1. Respondent characteristics**

Variable	Frequency	Percentage
<b>Age</b>		
Adult : 18-45 years old	62	39.2
Pre-elderly : 46-59 years old	58	36.7
Elderly : 60-65 years old	38	24.1
Total	158	100.0
<b>Gender</b>		
Male	19	12.0
Female	139	88.0
Total	158	100.0
<b>Family History of DM</b>		
Family History	46	29.1
No family History	112	70.9
Total	158	100.0
<b>Obesity</b>		
Obese	70	44.3
Not obese	88	55.7
Total	158	100.0
<b>Carbohydrate Intake</b>		
Not high	72	45.6
High	86	54.5
Total	158	100.0
<b>Social Economy</b>		
Below the minimum wage (< IDR 2,430,780 per month)	131	82.9
Within the minimum wage (IDR 2,430,780 per month)	16	10.1
Above the minimum wage (> IDR 2,430,780 per month)	11	7.0

Variable	Frequency	Percentage
Total	158	100.0
<b>Education Level</b>		
Elementary School	114	72.2
Junior School	22	13.9
High School	15	9.5
Academy/college	7	4.4
Total		100.0
<b>Physical Activity</b>		
Low	56	35.4
Medium	72	45.6
High	30	19.0
Total	158	100.0
<b>Diabetes Mellitus</b>		
Diabetes Mellitus	91	57.6
Non Diabetes Mellitus	67	42.4
Total	158	100.0

Source: Primary data processed by the authors, 2024

Based on the table above, shows that the majority of the subjects of this study were adults aged 18-45 years, 62 respondents (39.2%) female gender, 139 respondents (88.0%), 112 respondents (70.9%) did lack a history of diabetes mellitus in the family, not obese, 88 respondents (55.7%), high frequency of carbohydrate intake of 86 respondents (54.5%), below the minimum wage (< Rp2,430,780 per month) of 131 respondents (82.9%), elementary school education level of 114 respondents (72.2%), moderate physical activity of 72 respondents (45.6%), diabetes mellitus patients of 91 respondents (57.6%).

**Table 2. Factors that influence DM in the Kedaton Public Health Center**

Variable	Groups				P-value
	Diabetes Mellitus		Non Diabetes Mellitus		
	n	%	n	%	
<b>Age</b>					
18-45 years old	23	25.2	39	58.2	
46-59 years old	36	39.6	22	32.9	0.001*
60-65 years old	32	35.2	6	8.9	

<b>Total</b>	91	100.0	67	100.0
<b>Family History of DM</b>				
History	41	89.1	50	44.7
No history	5	10.9	62	55.5
<b>Total</b>	46	100.0	112	100.0
<b>Diet</b>				
No high	50	55.0	22	32.9
High	41	45.0	45	67.1
<b>Total</b>	91	100.0	67	100.0
<b>Education Level</b>				
Elementary School	75	82.4	39	58.3
Junior School	5	5.5	17	25.3
High School	8	8.8	7	10.4
Academy/college	3	3.3	4	6.0
<b>Total</b>	91	100.0	67	100.0

Source: Primary data processed by the authors, 2024

The statistical test results in Table 2 it is obtained as follows: the age variable obtained a *p-value* = 0.001 <0.05, the family DM history variable *p-value* = 0.001 <0.05, the diet variable obtained a *p-value* = 0.006 <0.05 and the education level variable *p-value* = 0.001 <0.05, it can be concluded that there is a significant influence between age, family DM history, diet, and education level with the incidence of DM.

**Table 3. Multivariate analysis results**

	Coefficient	S.E	Wald	df	P value	AOR	CI 95%	
							Min	Max
High	-1.089	.407	7.149	1	.007	.337	.152	.748
Family	-2.840	.586	23.488	1	.001	.058	.019	.184
Age	1.944	.531	13.398	1	.001	6.989	2.468	19.797
Constant	1.708	.662	6.653	1	.010	5.520		

Source: Primary data processed by the authors, 2024

carbohydrate History DM

Based on table 3. It was found that the most influential variable in the incidence of Diabetes Mellitus was age with a *p-value* = 0.001, OR = 6.98, (CI95% = 2.46 - 19.79).

This study's results indicate that the Chi-Square test obtained a *p-value* of 0.001 (*p* <0.05), AOR = 6.989, meaning that age significantly affects the incidence of diabetes Mellitus. These results follow research conducted by Evi and Rugun (2023), who found a considerable correlation (*p-value* = 0.000) between age and the incidence of diabetes Mellitus (Harefa & Lingga, 2023). According to the American Diabetes Association (ADA), the likelihood of

developing Diabetes Mellitus increases with age. Increased body fat composition leading to central obesity in the abdomen is the mechanism responsible for the increased risk of Diabetes Mellitus in older people. Insulin resistance is then triggered by central adiposity, and this is how Diabetes Mellitus begins (Irwan et al., 2021).

The results of this study show that the results of the Chi-Square test obtained a p-value of 0.001 ( $p < 0.05$ ), AOR = 0.019, which means that a family history of diabetes Mellitus has a significant effect on the incidence of diabetes Mellitus. This research was conducted by Irwan et al. (2021), which found a p-value of 0.000 ( $\leq 0.005$ ) that there is a relationship between diabetes mellitus and family history in prolans (chronic disease management program) participants at the South City Public Health Center Gorontalo City (Irwan et al., 2021). The main risk factor for diabetes mellitus is family history because, genetically, the sufferer will affect his offspring. Diabetes mellitus is the most significant genetic transmission disorder; 90% of children whose parents have this disease will inherit carriers of diabetes from them, one of which is characterized by abnormal insulin secretion (Susilawati & Rahmawati, 2021).

The results of this study indicate that the Chi-Square test results obtained a p-value of 0.006 ( $p < 0.05$ ), AOR = 0.337, which means that diet significantly affects the incidence of diabetes Mellitus.

The results of this study indicate that the Chi-Square test results obtained a p-value of 0.006 ( $p < 0.05$ ), AOR = 0.337, which means that diet significantly affects the incidence of diabetes Mellitus. This research was conducted by Suryanti S. et al. (2021), who found a strong correlation (result  $p = 0.010 < 0.05$ ) between the incidence of diabetes Mellitus and diet (Suryanti et al., 2021). In terms of food consumption, diet can be understood as a habit that is determined based on the following factors: food elements (meals, protein sources, vegetables, fruits), as well as frequency (daily, weekly, monthly, ever, never) (Musdalifah & Nugroho, 2020). Age, social level, culture, individual tastes, and habits are just a few of the variables that can affect someone's food choices and meal timing. Everyone has varying meal frequency (Musdalifah & Nugroho, 2020). All people should eat three meals a day on average. A person who lacks self-control over their daily food intake is more prone to disease than those who are careful when consuming food. Being overweight or malnourished can be triggered by improper eating habits. The chances of developing diabetes mellitus may increase as a result. Impaired insulin secretion and pancreatic function can be triggered by malnutrition. Insulin dysfunction can be triggered by being overweight (Musdalifah & Nugroho, 2020).

The results of this study indicate that the Chi-Square test obtained a p-value of 0.001 ( $p < 0.05$ ), AOR = 0.757, which means that the education level significantly affects the incidence of diabetes Mellitus. This is in reference to research by Annisa Pahlawati et al. (2019), which found a p-value of less than 0.05, indicating a relationship between the incidence of diabetes mellitus and education level (Pahlawati & Nugroho, 2020). The prevalence of diabetes mellitus is influenced by education level (Pahlawati & Nugroho, 2020). Highly educated people are usually knowledgeable about health, and because education is related to a person's work, education also affects a person's level of physical activity. People with higher education usually work in offices with minimal physical activity, while those with lower education are likelier to work as laborers or farmers with sufficient physical activity (Arania et al., 2021).

Age was the most dominant variable for the incidence of diabetes mellitus, with a p-value of  $0.001 < 0.05$  and an OR of 6.98 (CI 95% = 2.46 - 19.79). This finding is based on the multivariate test results. This is following the research of Hanggayu Pengestika et al. (2022), who found a significant effect of age ( $p = 0.002$ , OR = 0.156 (CI95% = 0.052-0.996)) on Diabetes Mellitus (Pangestika et al., 2022). A class of metabolic diseases known as diabetes mellitus is characterized by high blood sugar levels (hyperglycemia), which can be triggered by abnormal insulin action, secretion, or both (Mirna et al., 2020). Chronic hyperglycemia is associated with long-term damage or malfunction of vital organs, including the heart, kidneys,

blood vessels, nerves, and eyes (Mirna et al., 2020). A person with diabetes must be willing to adjust their diet in order to recover. Eating foods that contain many carbohydrates will not be beneficial for them. In addition, people with diabetes need to limit their food intake to prevent the entry of excessive amounts of glucose into the body (Mirna et al., 2020).

## CONCLUSION

In this study on risk factors for diabetes mellitus (DM) in Kedaton, Cirebon, the most influential factors included age ( $P = 0.001$ ,  $OR = 6.98$ ,  $95\% CI = 2.46-19.79$ ), family history of DM ( $P = 0.001$ ,  $OR = 0.058$ ,  $95\% CI = 0.019-0.184$ ), diet ( $P = 0.007$ ,  $OR = 0.337$ ,  $95\% CI = 0.152-0.748$ ), socioeconomic status ( $P = 0.019$ ,  $OR = 3.557$ ,  $95\% CI = 1.237-10.225$ ), and education level ( $P = 0.822$ ,  $OR = 0.757$ ,  $95\% CI = 0.067-8.575$ ). Families and communities should support DM patients during treatment to improve quality of life, including annual screening participation and involvement in control programs. Recommendations include enhancing routine screenings and education at Kedaton Health Center for at-risk groups, intensive nutrition counseling on low-carbohydrate diets, community-based interventions for healthy food access and activity among low-income groups, and stakeholder collaboration. For future research, a longitudinal study with a larger sample size is suggested to investigate additional risk factors and evaluate intervention effectiveness.

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