

Lifestyle as a Predictor of Diabetes Mellitus Incidence in Early Adulthood in Urban Areas: A Cross-Sectional Survey

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ABSTRACT

Diabetes mellitus is an increasing health problem, especially in the early adult age group in urban areas. This study aims to analyse the relationship between lifestyle, namely stress levels, physical activity, sleep patterns, and smoking behaviour, with the incidence of Diabetes Mellitus in early adults in urban areas of Riau Province, as well as identifying the dominant factors that influence balanced diet adherence in people with diabetes. The research design used a cross-sectional quantitative method with a sample of 375 respondents selected by simple random sampling. Data were collected through a structured questionnaire and analysed using the chi-square test and multiple logistic regression. The results showed that severe stress level ($p=0.012$; $OR=1.853$), low physical activity ($p=0.0001$; $OR=3.040$), and poor sleep pattern ($p=0.007$; $OR=1.863$) were significantly associated with the incidence of Diabetes Mellitus, while smoking behaviour was not significantly associated ($p=1.000$; $OR=0.978$). Multivariate analysis revealed physical activity as the dominant factor ($p=0.001$; $OR=3.961$). These findings emphasise the importance of lifestyle management especially increased physical activity, stress control, and improved sleep patterns in the prevention and management of Diabetes Mellitus in early adulthood. It is recommended that public health programmes integrate education and holistic interventions based on a multidisciplinary approach.

Keywords: *Diabetes Mellitus, Lifestyle, Physical Activity, Stress Level, Sleep Pattern, Diet Adherence*

INTRODUCTION

Type 2 diabetes mellitus (T2DM) has become a pressing global public health issue, with a rapid increase in prevalence over the past few decades. According to data from the International Diabetes Federation (IDF), it is estimated that by 2024, approximately 589 million adults aged 20–79 will be living with diabetes, and this number is projected to rise sharply to 853 million by 2050 if no effective interventions are implemented (IDF, 2024). This situation is exacerbated by a report from the World Health Organization (WHO) showing a surge in the prevalence of diabetes from 200 million in 1990 to 830 million in 2022, with more than half of sufferers undiagnosed or not receiving adequate treatment, thereby increasing the risk of serious complications and the economic burden on healthcare systems (WHO, 2024).

This situation is also highly relevant in Indonesia, where the prevalence of diabetes continues to increase. Based on the 2018 Riskesdas, the prevalence of diagnosed T2DM

among people aged ≥ 15 years reached 2%, up from 1.5% in the 2013 Riskesdas (Indonesian Ministry of Health, 2019). In the province of Riau, this situation is of particular concern, with a recorded prevalence of diabetes exceeding 90,000 cases in 2023, predominantly observed in coastal and urban regions such as Dumai, Bengkalis, and Pekanbaru, which have demonstrated remarkably high incidence rates (Health Office of Riau Province, 2023). This situation necessitates expeditious and targeted action to avert a surge in diabetes cases, which would impose a substantial burden on individuals' quality of life and exacerbate the strain on healthcare systems. The rise in the prevalence of diabetes among the working age population has the potential to jeopardise national productivity and result in a substantial economic burden (Dall et al., 2019).

Various risk factors have been identified as the main causes of the increase in the incidence of type 2 diabetes mellitus (T2DM), including genetic, lifestyle, sociodemographic, and environmental factors. Family history and genetic predisposition have been proven to contribute significantly to the risk of developing T2DM (Firdous et al., 2022; Strati et al., 2024). However, lifestyle factors such as obesity, especially abdominal obesity, unhealthy eating patterns, lack of physical activity, smoking, and alcohol consumption are modifiable factors that play an important role in the development of this disease (Tripathy et al., 2018). In addition, sociodemographic factors such as increasing age, certain ethnic groups, and low socioeconomic status also increase the risk of diabetes through limited access to health services and unhealthy lifestyles (Kyou et al., 2020). Environmental changes resulting from urbanisation also increase the risk of diabetes through unhealthy lifestyle changes and exposure to pollutants that can disrupt glucose homeostasis (Tripathy et al., 2018). Additionally, medical conditions such as hypertension, dyslipidaemia, and metabolic syndrome act as clinical factors that exacerbate the progression of type 2 diabetes mellitus (T2DM) (Molina de Salazar & Muñoz-Gómez, 2018).

Despite the plethora of global studies conducted on diabetes risk factors, there remains a paucity of comprehensive studies examining the role of lifestyle factors, particularly stress levels, sleep patterns and physical activity, among young adults in urban areas of Indonesia. This is particularly evident in Riau Province, which exhibits a high prevalence of diabetes, underscoring the urgent need for local research integrating these lifestyle variables to identify targeted interventions. The present study aims to address this gap by analysing the relationship between lifestyle and the incidence of diabetes mellitus among young adults in urban areas of Riau Province, as well as determining which lifestyle factors most significantly influence adherence to a balanced diet among diabetes patients. Consequently, it is anticipated that this study will provide a foundational basis for the development of more effective and contextually appropriate prevention and management strategies for diabetes in this region

METHODS

Research Design and Location

This study employs a quantitative design with a cross-sectional survey method to analyse the relationship between lifestyle and the incidence of Diabetes Mellitus (DM) among young adults (aged 18–45 years) in urban areas of Riau Province. The study was conducted in several cities/districts in Riau Province with relatively high diabetes prevalence. Data were collected from June to December 2024.

Population and Sample

The study population consisted of early adults aged 18–45 years living in urban areas of Riau Province. The sample size of 375 respondents was calculated using a sample calculation method for a two-proportion hypothesis with a 95% confidence level (z-value of 1.96) and 80% power (z-value of 0.84), as well as a margin of error of 3.48%. The sample was selected using simple random sampling to ensure that every individual in the population had an equal chance of being selected, thereby ensuring that the research results proportionally represent the characteristics of the population.

Data Collection Procedure

Data was collected through a survey using a structured questionnaire that included questions about demographic characteristics, stress levels, physical activity, sleep patterns, smoking behaviour, and diabetes mellitus diagnosis status obtained from medical records or valid self-reports. Data collection was conducted through face-to-face interviews by enumerators who had received special training to ensure the accuracy and consistency of the data obtained during the collection process.

Research Variables

The dependent variable in this study is the occurrence of diabetes mellitus, which is categorised as present or absent based on medical diagnosis. The independent variables consist of lifestyle factors, including stress level (moderate/severe) physical activity (sufficient/insufficient), sleep pattern (good/poor), and smoking behaviour (smoker/non-smoker).

Data Analysis

The analysis of the data was conducted utilising the SPSS statistical software version 26. A descriptive analysis was conducted to characterise the respondents and the distribution of lifestyle variables. The relationship between the categorical variables was examined through the implementation of bivariate analysis, which employed the chi-square test. Furthermore, multivariate analysis using logistic regression was conducted to identify significant lifestyle factors influencing the occurrence of DM, with a p-value <0.05 considered significant. The strength of the relationship was measured using odds ratios (OR) and 95% confidence intervals (CI).

RESULTS

A total of 375 respondents participated in this study (Table 1). The respondents' ages were divided into three groups: 18–25 years (12.5%), 26–35 years (19.5%), and 36–45 years (68.0%). The majority of respondents were female (54.7%). The majority of respondents had a high school education (52.3%), followed by junior high school (27.5%) and higher education (15.2%). The most common occupations were housewife (50.7%) and entrepreneur (15.5%).

Table 1. Characteristics of respondents based on age, education, and occupation

NO	Characteristics	n	%
1	Age		
	18-25 years	47	12.5
	26-35 years	73	19.5
	36-45 years	255	68.0
2	Gender		
	Male	170	45.3
	Female	205	54.7
3	Education		
	Elementary School	4	1.1
	Junior High School	103	27.5
	Senior High School	196	52.3
	Higher Education	57	15.2
	No Formal Education	15	4.0
4	Occupation		
	Housewife	190	50.7
	Government Employee	40	10.7
	Farmer/Fisherman	41	10.9
	Entrepreneur	58	15.5

Unemployed	19	5.1
Other	27	7.2
Total	375	100

Table 2. Overview of DM Incidence and Lifestyle in Early Adulthood in Urban Areas

NO	Variable	n	%
1	DM Incidence		
	DM	126	33.6
	No	249	66.4
2	Stress Level		
	Severe	233	62.1
	Moderate	142	37.9
3	Physical Activity		
	Insufficient	220	58.7
	Sufficient	155	41.3
4	Sleep Patterns		
	Poor	194	51.7
	Good	181	48.3
5	Smoking Behaviour		
	Smokers	174	46.4
	Non Smokers	201	53.6
	Total	375	100.0

Table 2 shows that 33.6% were diagnosed with Diabetes Mellitus (DM), while 66.4% were not. Severe stress levels were reported by 62.1% of respondents. Insufficient physical activity was performed by 58.7%, and unfavourable sleep patterns by 51.7% of respondents. A total of 46.4% of respondents were smokers.

Table 3. Relationship Between Lifestyle and Diabetes Mellitus Incidence in Urban Early Adulthood Age Group

NO	Lifestyle	Incidence of Diabetes Mellitus				Total	<i>P-Value</i>	OR (95% CI)	
		DM		No					
		n	%	n	%				n
1	Stress Level								
	Severe	90	38,6	143	61,4	233	100	0,012	1,853
	Moderate	36	25,4	106	74,6	142	100		1,169-2,938
2	Physical Activity								
	Insufficient	95	43,2	125	56,8	220	100	0,0001	3,040
	Sufficient	31	20,0	124	80,0	155	100		1,890-4,891
3	Sleep Patterns								
	Poor	78	40,2	116	59,8	194	100	0,007	1,863
	Good	48	26,5	133	73,5	181	100		1,203-2,885
4	Smoking Behaviour								
	Smokers	58	33,3	116	66,7	174	100	1,000	0,978
	Non Smokers	68	33,8	133	66,2	201	100		0,636-1,503

Table 3 shows that severe stress levels are significantly associated with the incidence of diabetes mellitus ($p=0.012$; $OR=1.853$; $95\% CI: 1.169-2.938$). Insufficient physical activity is also significantly associated with the occurrence of Diabetes Mellitus ($p=0.0001$;

OR=3.040; 95% CI: 1.890–4.891). Poor sleep patterns are significantly associated with the occurrence of Diabetes Mellitus ($p=0.007$; OR=1.863; 95% CI: 1.203–2.885). However, smoking behaviour is not significantly associated with the occurrence of Diabetes Mellitus ($p=1.000$; OR=0.978; 95% CI: 0.636–1.503).

Table 4. Dominant Factors of Balanced Diet Adherence in Patients with Diabetes Mellitus

NO	Lifestyle	B	P-value	OR	95%CI	
					Lower	Upper
1	Stress Level	1.153	0.001	3.168	1.883	5.331
2	Physical Activity	1.376	0.001	3.961	2.369	6.621
3	Sleep Patterns	0.917	0.001	2.502	1.479	4.232
4	Smoking Behaviour	-0.473	0.073	0.623	0.372	1.045

The results of the multivariate analysis (Table 4) indicate that physical activity is the most dominant factor significantly associated with adherence to a balanced diet among diabetes mellitus patients ($p=0.001$; OR=3.961; 95% CI: 2.369–6.621). Stress levels are also significantly associated with diet adherence ($p=0.001$; OR=3.168; 95% CI: 1.883–5.331), followed by sleep patterns, which show a significant association with a lower influence ($p=0.001$; OR=2.502; 95% CI: 1.479–4.232). Conversely, smoking behaviour was not significantly associated with dietary adherence in this analysis ($p=0.073$; OR=0.623; 95% CI: 0.372–1.045).

DISCUSSION

The findings of this study suggest that lifestyle has a substantial role as a predictor of diabetes mellitus (DM) in early adulthood in urban areas. Preliminary research indicates a strong correlation between high levels of stress, lack of physical activity and poor sleep patterns on the one hand, and type 2 diabetes (DM) on the other. However, the data on smoking behaviour does not support the hypothesis that it is significantly associated with the development of DM. These findings are consistent with the findings of various studies indicating that psychological stress is a primary risk factor in the development of Type 2 Diabetes Mellitus (T2DM). As Tudpor (2021) reported, individuals at risk of type 2 diabetes mellitus (T2DM) exhibit higher levels of psychological stress and lower heart rate variability, indicating a strong correlation between stress and diabetes risk (Tudpor et al., 2021). In addition, acute stress-induced hyperglycaemia (stress hyperglycaemia) has been linked to the development of diabetes in patients who experience it (Koyuncu et al., 2017; Moradi et al., 2015). Mechanistically, stress affects glucose homeostasis through various molecular pathways that cause insulin resistance (Yaribeygi et al., 2022), and dysregulation of the hypothalamic-pituitary-adrenal (HPA) axis, which plays a role in T2DM (Joseph & Golden, 2017). Increased cortisol levels and inflammatory biomarkers such as IL-8 in type 1 diabetes patients with high stress correlate with poor glycemic control (Pankiv et al., 2025). In addition, chronic stress has a negative impact on adherence to treatment, diet, and physical activity, exacerbating diabetes (Natesan et al., 2016). Therefore, early detection and management of stress should be an integral part of DM prevention and management strategies.

The results of this study also confirm the important role of physical activity in reducing the risk of DM. Physical activity has a significant impact on the incidence and management of diabetes mellitus, particularly type 2 diabetes mellitus (T2DM). The relationship between physical activity and diabetes has been well documented, with many studies highlighting the benefits of regular exercise in reducing the risk and managing the condition (Rietz et al., 2022; Smith et al., 2016). Even 150 minutes of moderate physical activity per week can reduce the risk of T2DM by 26%, with greater benefits at higher intensities (Ubeira González et al., 2025). The main mechanisms of these benefits are improved insulin

sensitivity, better glucose control, and improved metabolic function (Jáuregui-Ulloa et al., 2023; Ohri et al., 2015). Therefore, public health recommendations should emphasise the importance of regular physical activity, at least 30 minutes per day (Smith et al., 2016). Educating the public on the benefits of a healthy lifestyle is crucial to reduce the prevalence of sedentary lifestyles that contribute to the diabetes epidemic (Hermawan et al., 2024; Purwaningsih & Solikhah, 2020).

Poor sleep patterns have also been shown to contribute to an increased risk of DM, in line with previous studies showing a significant association between short sleep duration (<7 hours) and an increased risk of T2DM (Liu et al., 2025; Najafian et al., 2013; Zhang et al., 2025). A U-shaped relationship between sleep duration and diabetes risk was also reported, where sleeping more than 8 hours per night also increased the risk of diabetes (Chao et al., 2011). Poor sleep quality, including disorders such as insomnia and sleep apnoea, is associated with inflammation and insulin resistance that worsen glycaemic control (Khandelwal et al., 2017). The biological mechanism involves insulin resistance due to short sleep duration and chronic inflammatory response (Alnaji et al., 2016; Sekizuka & Miyake, 2023). Therefore, optimal sleep management, including interventions for sleep disorders, may be an effective DM prevention and management strategy (Tajiri & Wada, 2023).

Contrary to the findings of certain studies that have demonstrated a substantial correlation between smoking and an elevated risk of diabetes (Chang, 2012; White et al., 2018), this investigation did not ascertain a statistically significant association between smoking behaviour and the occurrence of diabetes mellitus (DM) in the study population. Nevertheless, smoking continues to exert a detrimental influence on micro- and macrovascular complications in diabetic patients (López Zubizarreta et al., 2017). The mechanisms involved include insulin resistance, inflammation, and dyslipidaemia due to smoking. It is important to note that although smoking cessation may increase the risk of diabetes in the short term due to metabolic changes, in the long term it provides significant benefits for glycemic control and reduction of insulin resistance (Ohkuma et al., 2015). Therefore, smoking cessation should remain an important part of diabetes management.

The principal limitation of this study is its cross-sectional design, which precludes the drawing of causal conclusions between lifestyle and DM incidence. Furthermore, the collection of lifestyle data was conducted through self-reporting, a method that has been demonstrated to introduce information bias. It is recommended that future studies employ a longitudinal design and objective measurement methods for lifestyle variables. In order to ascertain the efficacy of integrated interventions combining stress management, increased physical activity, and improved sleep patterns in the prevention and management of diabetes, it is essential to conduct a thorough evaluation. The study results confirm that stress management, increased physical activity, and improved sleep patterns are key strategies in reducing the risk and managing diabetes mellitus in young adults in urban areas. The implementation of public health programmes emphasising these aspects, in conjunction with education and a multidisciplinary approach by healthcare professionals, is imperative in order to reduce the prevalence and complications of diabetes.

CONCLUSION

The present study indicates that lifestyle factors, particularly stress levels, physical activity, and sleep patterns, are significant determinants of the incidence of diabetes mellitus among young adults in urban areas. In the context of diabetes prevention and management, there is a compelling evidence base supporting the efficacy of stress management, increased physical activity, and improved sleep quality. Consequently, it is recommended that public health programmes prioritise education and holistic interventions involving a multidisciplinary approach to optimise health outcomes. It is imperative that further research is conducted utilising longitudinal designs and more objective measurement methods in order to consolidate these findings and develop more effective intervention strategies.

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