



**THE RELATIONSHIP BETWEEN LIFESTYLE AND STRESS LEVELS WITH
THE INCIDENCE OF DIABETES MELLITUS: LITERATURE STUDY**

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ABSTRACT

Diabetes Mellitus (DM) is a chronic disease marked by high blood glucose due to insulin dysfunction. Its prevalence is rising, with Indonesia ranking seventh globally. Unhealthy lifestyles and stress exacerbate the issue, highlighting the need for improved prevention and management strategies. This study examines how lifestyle and stress influence DM incidence in Indonesian patients, identifying risk factors to enhance healthcare strategies. A systematic review using PRISMA guidelines analyzed studies from various databases (2019-2024), selecting relevant articles based on inclusion criteria and extracting key research data. From 10 reviewed journals, 4 linked lifestyle to DM, 1 identified sedentary behavior as a prediabetes risk, and 5 highlighted stress as a major factor. Preventing and managing DM requires a healthy lifestyle, stress management, and healthcare interventions to enhance patient well-being while reducing economic and health burdens.

Keywords: blood glucose level; diabetes mellitus; lifestyle; stress level

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INTRODUCTION

Diabetes Mellitus (DM) is a chronic medical condition that causes increased blood glucose levels due to impaired use or secretion of insulin. Insulin is a hormone produced by the pancreas, which functions to help body cells absorb glucose from the blood and use it as an energy source. When insulin production or effectiveness is impaired, glucose builds up in the blood, causing high blood sugar levels (Setiawan, 2021). DM is a serious threat to global health and the national economy. The number of DM cases continues to increase every year, indicating that this disease is a significant public health problem. According to the International Diabetes Federation (IDF), in 2019 there were around 463 million people aged 20-79 years worldwide who suffered from DM. Indonesia itself is ranked seventh as the country with the highest number of DM cases (IDF, 2019). The increase in DM cases has a major impact on the health system and economy, given the high cost of care and the need for long-term management (Maruf & Palupi, 2021).

The significant increase in the prevalence of diabetes mellitus (DM) is caused by various unhealthy lifestyle factors. One of the triggers is poor diet, namely consumption of foods high in sugar, fat, and calories, which directly increases the risk of developing DM (Widagdo et al., 2024). In addition, lack of physical activity is also a major contributor, because a less active lifestyle can lead to obesity, which is one of the main risk factors for DM (Astutisari et al., 2022). Not only that, high levels of chronic stress also affect the balance of hormones in the body, including stress hormones such as cortisol, which can interfere with blood glucose control. The combination of these factors makes an unhealthy lifestyle the main cause of the increase in DM cases in the community (Widiastuti et al., 2024).

Type 2 DM, the most common, is often caused by insulin resistance. Insulin resistance occurs when the body's cells do not respond well to insulin, so that glucose cannot be absorbed efficiently by the cells (Paleva, 2019). In addition, dysfunction of pancreatic beta cells, which are responsible for producing insulin, is also a major cause of type 2 DM. An unhealthy lifestyle, such as poor diet and lack of physical activity, contributes to the development of insulin resistance and pancreatic beta cell dysfunction (Setiawan, 2021). Stress plays an important role in controlling blood glucose levels. Increased stress hormones such as cortisol can interfere with the effectiveness of insulin, leading to increased blood glucose levels (American Diabetes Association, 2022). Diabetes Mellitus (DM) can result in various serious complications that affect various organs of the body. These complications include heart disease, nerve damage, kidney failure, and visual impairment. This condition not only affects the health of the individual, but also requires very high treatment costs and requires a fairly long treatment time. This causes a significant burden on the health system and the economy (Rif'at et al., 2023).

To reduce the negative impact of DM, it is essential to understand the lifestyle factors and stress levels that contribute to the occurrence of this disease. With this knowledge, more effective prevention and management strategies can be developed, thereby reducing the burden of complications caused by DM (Hermawan et al., 2021). Healthy lifestyle management and good stress management are key in preventing and controlling DM and improving the quality of life for sufferers (Waluyo et al., 2024). Based on the background that has been presented, this study aims to explore the relationship between lifestyle and stress levels with the incidence of DM in patients in various locations in Indonesia. This study provides a new contribution in understanding how lifestyle and stress affect the incidence of DM in Indonesia in an effort to prevent DM through a non-pharmacological approach, as well as providing evidence-based recommendations to improve the quality of life of individuals at risk or who have experienced DM. The importance of adopting a healthy lifestyle, including a balanced diet, regular physical activity, and good stress management, cannot be underestimated in efforts to prevent and control DM. This approach not only helps reduce the risk of developing DM but also improves the quality of life for individuals who already suffer from this disease (Widagdo et al., 2024). The purpose of this study was to explore the relationship between lifestyle and stress levels with the incidence of Diabetes Mellitus (DM) in patients in Indonesia. This study aims to identify the main risk factors that contribute to the increase in DM cases, so that they can be the basis for designing more effective disease prevention and management strategies. In addition, the results of this study are expected to support public education and health interventions to improve the quality of life of DM sufferers and reduce the economic and health burden due to complications of this disease.

METHOD

The type of method used is secondary research using the *literature review method*. The type of review in this study is a *narrative review*. *Narrative review* is a narrative literature review process with a synthesis of published literature on a topic and describes the current state (Ferrari, 2015). The procedure used in this study is *Preferred Reporting Items for Systematic Reviews and Meta Analyses* (PRISMA). PRISMA helps researchers ensure that *systematic review* reports are transparent and complete (Page et al., 2021). The inclusion criteria in this study were articles that were in the main research, on the relationship between lifestyle and stress levels with the incidence of diabetes mellitus. Articles published in the last 5 years, and focused on articles that discussed the relationship between lifestyle and the incidence of DM and the relationship between stress levels and the incidence of DM. Only articles that had explicit findings related to lifestyle and stress levels in DM patients were included in this study. Article findings in the form of healthy lifestyles such as vegetarianism, consumption of

nutritious foods, regular exercise and literature that was not available in full text were excluded from this study as many as 128 articles.

The articles in this study were reviewed through a systematic process that included several main stages. Article searches were conducted through various databases such as Emerald, PubMed, ProQuest, ScienceDirect, and Google Scholar using the keywords "*diabetes mellitus*," "*lifestyle*," "*stress levels*," and "*blood glucose levels*". The articles found were then selected based on inclusion and exclusion criteria, such as publication period (2019-2024) and language (Indonesian or English), to ensure the relevance of the study. After the selection stage, five articles that met the criteria were analyzed by considering aspects such as author, year of publication, country, research objectives, study design, number of respondents, main findings, and research implications. Data from the various articles were then synthesized and compared to obtain conclusions regarding the relationship between lifestyle and stress levels with the incidence of Diabetes Mellitus. With this systematic approach, the study can ensure that the conclusions drawn are based on valid and current scientific evidence.

RESULT

The author in searching for articles conducted a search using keywords that had been compiled. After selection based on inclusion and exclusion criteria, the review results obtained 10 articles that were in accordance with the previously determined PRISMA. Articles that are in accordance with the theme are the relationship between lifestyle and stress levels with the incidence of diabetes mellitus. Researchers need to develop knowledge about the relationship between lifestyle and stress levels with the incidence of diabetes mellitus created by researchers. Based on this theme, 10 articles were obtained. Then the 10 articles were analyzed. Below is a list of 10 articles extracted in table form:

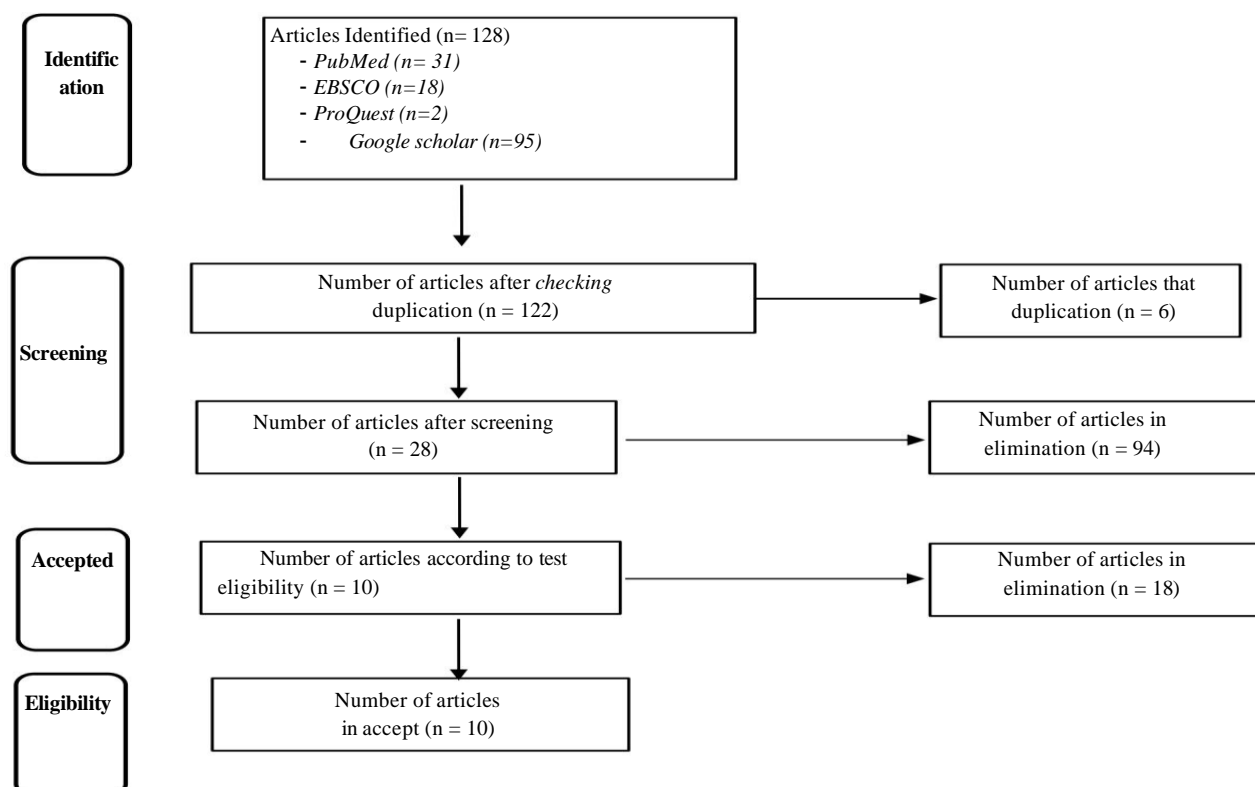


Figure 1. Literature Search and Selection Process Using the PRISMA Procedure

Table 1.
Article Analysis

No	Article Title	Writer & Year	Objective Study	Method Study	Research result
1	Relationship between Stress Levels and Blood Sugar Levels in Diabetes Mellitus Patients in Depok Village, Toroh District	(Sutrisno et al., 2024)	Knowing the relationship between stress levels and blood sugar levels of diabetes mellitus patients in Depok Village, Toroh District	Case design control retrospective purposive sampling, chi-square test	The results of the study in Depok Village showed a relationship between stress levels and blood sugar levels in people with diabetes mellitus, with a p-value of $0.034 < \alpha$ (0.05). The odds-ratio value of 0.185 indicates that respondents with a stress level of 0.185 times have abnormal blood sugar levels.
2	Relationship between Lifestyle and the Incidence of Type 2 Diabetes Mellitus in Patients at Royal Prima Hospital Medan	(Elisabeth et al., 2024)	Knowing the relationship between lifestyle and event Diabetes Mellitus Type 2 and respondents' understanding of lifestyle as a trigger	Cross-design sectional, 50 respondents	Alcohol consumption is the most crucial lifestyle factor in increasing the risk of developing diabetes mellitus symptoms. Although the results of smoking habits and sleep patterns are not significant, this factor still influences the risk of diabetes mellitus
3	The Relationship between Sedentary Lifestyle and the Incidence of Prediabetes in the Work Area of Johar Baru Health Center	(Ambarita et al., 2022)	Determining the relationship between sedentary lifestyle and the incidence of prediabetes in the Johar Baru Health Center work area	Correlation design descriptive approach cross-sectional, purposive sampling	Most respondents have frequent sedentary behavior (93.8%) and high risk of prediabetes (54.7%) followed by very high risk of prediabetes (23.4%). High risk of prediabetes is significantly correlated with sedentary lifestyle in daily life.
4	The Relationship Between Stress Levels and Quality of Life of Diabetes Mellitus Patients in the Work Area of Surakarta General Hospital	(Maruf & Palupi, 2021)	to determine the relationship between stress levels and the quality of life of DM patients at Surakarta General Hospital	Cross-sectional. Sampel of 59 DM patients. Accidental sampling	Quality of life of DM patients at work in Surakarta General Hospital, the majority of their quality of life is not good. The stress level of DM patients at work in Surakarta General Hospital is mostly in the severe category and there is a significant relationship between stress levels and the quality of life of DM patients.
5	Relationship between Lifestyle and Diet with the Incidence of Diabetes Mellitus at Bhayangkara Hospital, Makassar City	(Suryanti, 2021)	Knowing the relationship between lifestyle and diet with the occurrence of DM in the hospital Bhayangkara Makasar City	Analytical survey cross-sectional study, 64 respondents, simple random sampling	There is a relationship between smoking habits ($p=0.042$), physical activity ($p=0.027$), and diet ($p=0.010$) with the incidence of diabetes mellitus. There is no relationship between the habit of consuming alcoholic beverages ($p=0.628$) with the incidence of diabetes mellitus.
6	Relationship between Diet and Physical Activity with the Incidence of Diabetes Mellitus at the NTB Provincial Hospital	(Hariawan et al., 2019)	Knowing the relationship between diet and physical activity with DM incidence in RSU West Nusa Tenggara Province	Observational design analytics retrospective study, sample 60 people, purposive sampling, test Chi-Square	There is a relationship between lifestyle, dietary patterns ($p=0.02 < \alpha=0.05$) and physical activity ($p=0.009 < \alpha=0.05$) with the incidence of DM
7	Relationship between Lifestyle and Quality of Life in Type 2 Diabetes Patients with Diabetic Foot Problems	(Ritonga et al., 2024)	Determine The relationship between lifestyle and quality of life in type 2 diabetes patients with foot problems diabetic	Case design control and retrospective approach. Number of respondents: 50 people, Purposive sampling technique. Statistical : chi-square test.	The p value = 0.044 shows a significant relationship between lifestyle and quality of life. Odds ratio = 3.886 (95% CI, 1.191-12,681), indicating that respondents with a poor lifestyle were 3.8 times more likely to have a bad quality of life.
8	Relationship Between Stress Levels and Blood Sugar Levels in Diabetes Mellitus Patients at Community Health Centers	(Safari & Salvia, 2022)	Knowing the relationship between stress levels and changes in blood sugar levels in diabetes mellitus patients at the	Correlational analysis with cross-sectional method, 30 people, incidental sampling, Spearman Rank statistical test	There is a relationship between stress levels and blood sugar levels, the correlation coefficient shows a fairly strong and unidirectional relationship.

		Community Health Center		
9	The Effect of Stress on Blood Glucose Levels in Hyperglycemia Patients in the Kunciran Baru Health Center Area, Tangerang City	(Yohana et al., 2024)	Knowing the effect of stress on blood glucose levels in patients with hyperglycemia	Quantitative research with nested case control design, 89 respondents, simple random sampling, T-test
10	Stress Levels with Blood Sugar Levels in Diabetes Mellitus Patients in RW 7, Simokerto Village, Surabaya	(Bistara et al., 2019)	Knowing the relationship between stress levels and blood sugar levels in people with Diabetes Mellitus	Observational, cross-sectional analysis, sample of 45 respondents, simple random sampling, Spearman Rank correlation test
				Stress is a factor that can affect blood glucose levels in DM sufferers and the ability to manage stress is important in efforts to maintain normal blood glucose levels.
				There is a significant relationship between stress levels and blood sugar levels in people with Diabetes Mellitus. The p value = 0.00 and r = 0.909 indicate that the higher the level of stress experienced, the higher the blood sugar levels.

The article selection process uses the PRISMA diagram. In a search of four databases, a total of 128 articles were identified, PubMed 31 articles, Emerald 18 articles, ProQuest 2 articles and Google Scholar 95 articles. At the screening stage, 6 articles were excluded which were duplicate articles, review articles, time spans of more than 5 years, so that 122 articles were obtained. Furthermore, screening on the title and abstract, obtained 94 articles that were excluded because they did not match the research question and 18 articles were excluded again because they did not match the inclusion criteria. Thus, 10 articles were obtained that were included in this review (Figure 1). The included studies ranged from publication years 2019 to 2024. The samples in this study were all diabetes mellitus patients.

Based on the results of 10 reviewed journal articles, 5 articles were obtained stating that there is a relationship between lifestyle and the incidence of diabetes mellitus. The lifestyle in question, namely, unhealthy eating patterns, sedentary lifestyle, smoking habits, lack of physical activity, and poor eating patterns also have a significant relationship with the incidence of diabetes mellitus, although consumption of alcoholic beverages does not show a significant relationship. In addition, there are 4 articles stating that there is a significant relationship between stress levels and blood sugar levels in people with diabetes mellitus, and 1 article stating that there is a positive relationship between stress levels and quality of life of patients with diabetes mellitus. From the 10 articles, it was found that the majority of respondents with abnormal blood sugar levels were those aged 46-60 years, with a diverse distribution of respondent ages ranging from under 45 years in 1 article, then over 60 years in 2 articles and 7 articles aged 46-60 years. Male respondents tend to have normal blood sugar levels, while the majority of respondents in this study were female. The respondents' education levels varied, ranging from the last education of high school, junior high school, or bachelor's degree, to basic education (SD) and SLTA/MA.

Based on occupation, the majority of respondents are unemployed, work as laborers or housewives, and private employees. High stress levels were found in most respondents, with the majority of diabetes mellitus (DM) patients experiencing severe or mild stress levels, and significant stress levels or no stress. Respondents' physical activity and lifestyle showed that the majority did not do physical activity for at least 30 minutes a day, with a sedentary lifestyle or healthy diet. In addition, the majority of respondents had a varied lifestyle between good or bad, as well as a normal or bad diet. These findings highlight the importance of considering factors such as age, gender, education, occupation, stress levels, physical activity, and lifestyle in research related to diabetes mellitus. The results of the article analysis contain several important conclusions that can be drawn. From 10 journals that have been reviewed, the results of the analysis show that as many as 5 articles say there is a relationship between stress levels and blood sugar levels. This shows that stress has a significant effect on increasing blood sugar levels in people with diabetes mellitus Research by Sutrisno et al.,

(2024) found that respondents with higher stress levels were 0.185 times more likely to have abnormal blood sugar levels, while Bistara et al., (2019) showed that the higher the stress level, the higher the blood sugar level with a p value = 0.00 and $r = 0.909$. In addition, there is 1 article that shows that sedentary behavior is highly correlated with the risk of prediabetes, with the majority of respondents having a high risk of prediabetes Ambarita et al., (2022). Alcohol consumption is also a crucial factor in increasing the risk of diabetes mellitus, although smoking habits and sleep patterns also affect the risk (Elisabeth et al., 2024). Research by (Maruf & Palupi, 2021) shows that diabetes mellitus (DM) patients at Surakarta General Hospital mostly have poor quality of life, with high stress levels negatively affecting their quality of life.

In addition, there are 4 articles that show a significant relationship between lifestyle and the incidence of DM. The results of Suryanti's study, (2021) found a significant relationship between smoking habits, physical activity, and diet with the incidence of diabetes mellitus. Ritonga et al., (2024) identified that a bad lifestyle significantly affects quality of life, with respondents who have a bad lifestyle 3.8 times more likely to have a poor quality of life. Finally, research by Safari & Salvia, (2022) and Yohana et al., (2024) highlighted the importance of stress management in maintaining normal blood glucose levels in people with diabetes mellitus.

DISCUSSION

Diabetes Mellitus (DM) is a chronic medical condition that causes increased blood glucose levels due to impaired use or secretion of insulin. Insulin is a hormone produced by the pancreas, which functions to help body cells absorb glucose from the blood and use it as an energy source. When insulin production or effectiveness is impaired, glucose builds up in the blood, causing high blood sugar levels (Setiawan, 2021). The significant increase in the prevalence of diabetes mellitus (DM) is caused by various unhealthy lifestyle factors. One of the triggers is poor diet, namely consumption of foods high in sugar, fat, and calories, which directly increases the risk of developing DM (Widagdo et al., 2024). In addition, lack of physical activity will cause increased blood sugar levels in the body (Astutisari et al., 2022). Not only that, high levels of chronic stress also affect the balance of hormones in the body, including stress hormones such as cortisol, which can interfere with blood glucose control. The combination of these factors makes an unhealthy lifestyle the main cause of the increase in DM cases in the community (Widiastuti et al., 2024). Unhealthy lifestyles, such as poor diet and lack of physical activity, contribute to the development of insulin resistance and pancreatic beta cell dysfunction (Setiawan, 2021). To reduce the negative impact of DM, it is essential to understand the lifestyle factors and stress levels that contribute to the occurrence of this disease. With this knowledge, more effective prevention and management strategies can be developed, thereby reducing the burden of complications caused by DM (Hermawan et al., 2021). Healthy lifestyle management and good stress management are key in preventing and controlling DM and improving the quality of life for sufferers (Waluyo et al., 2024). The importance of adopting a healthy lifestyle, including a balanced diet, regular physical activity, and Good stress management cannot be underestimated in efforts to prevent and control DM. This approach not only helps reduce the risk of developing DM but also improves the quality of life for individuals already suffering from this disease (Widagdo et al., 2024).

The results of this literature study indicate that unhealthy diet, sedentary lifestyle, alcohol consumption, and smoking habits have a significant relationship with the risk of diabetes mellitus. Hariawan et al., (2019) found that nutritional imbalance in diet can increase blood sugar levels, triggering diabetes. Ambarita et al., (2022) stated that a sedentary lifestyle is at high risk for prediabetes because it reduces insulin sensitivity. Ritonga et al., (2024) added that poor lifestyle reduces the quality of life of type 2 diabetes sufferers

with diabetic foot problems. Elisabeth et al., (2024) identified alcohol consumption as a crucial factor in increasing the risk of type 2 diabetes mellitus, while Suryanti, (2021) showed that smoking, low physical activity, and poor diet were associated with the incidence of diabetes, but alcohol consumption was not significant.

Research also highlights the importance of stress management. Sutrisno et al., (2024) found that stress increases blood sugar levels in people with diabetes. Maruf & Palupi, (2021) and Safari & Salvia, (2022) stated that stress is positively related to the quality of life of diabetic patients and poor blood sugar levels. Yohana et al., (2024) and Bistara et al., (2019) confirmed that stress affects blood glucose levels, underlining the importance of stress management skills. Research shows there is a relationship between lifestyle and stress levels and the incidence of diabetes mellitus. A healthy diet, avoiding a sedentary lifestyle, reducing alcohol and smoking consumption, and managing stress are very important to prevent and control diabetes. Education and intervention from health workers are also crucial to improving the quality of life of diabetes sufferers. Although there are still few articles discussing this relationship, the existing evidence is quite strong because it comes from official literature and is of high quality. Further research is needed to strengthen these findings.

CONCLUSION

The conclusion of this literature study is that stress levels and lifestyle have an important role in influencing the incidence of diabetes mellitus (DM). The study found a significant relationship between stress levels and blood sugar levels in DM patients. Lifestyle factors such as alcohol consumption, smoking habits, physical activity, and diet have a significant impact on the risk of DM symptoms, with alcohol consumption as the most influential factor. Meanwhile, sleep patterns did not show a significant effect on the incidence of DM. A sedentary lifestyle was also found to have a significant relationship with the incidence of prediabetes. Thus, stress management and adoption of a healthy lifestyle are key steps in maintaining health and preventing diabetes mellitus. Efforts to develop more effective prevention strategies can be done by understanding and managing these two factors.

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