

Analysis of Diabetes Mellitus Risk Factors with Lifestyle

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ABSTRACT

Introduction : *Diabetes mellitus is a disease characterized by elevated blood sugar levels caused by the use or production of insulin. An unhealthy lifestyle is one of the causes of diabetes mellitus. Poor diet, the habit of consuming sugary foods and drinks, lack of physical activity, smoking, and never checking blood sugar levels can increase the risk of type 2 diabetes mellitus*

Objectives : *To analyze of risk factors for diabetes mellitus with lifestyle at SMA N 2 Sukoharjo.*

Methods: : *This type of research is a quantitative cross-sectional design with a sample of 75 respondents. The instrument used in this study was a lifestyle and risk factor questionnaire. Data were analyzed using the Spearman rank test .*

Conclusions: *There was a dominant relationship between lifestyle and history of diabetes mellitus (p -value = 0.000) and beta(0.609).*

Keyword: *diabetes mellitus, lifestyle and risk factors.*

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Introduction

Diabetes mellitus is a metabolic disorder characterized by increased blood glucose levels (hyperglycemia) due to the use or production of insulin (1). A person is considered to suffer from Diabetes Mellitus (DM) if the fasting blood glucose test result reaches 126 mg/dL or if random blood glucose exceeds 200 mg/dL (2). The number of people with diabetes mellitus in 2025 is estimated to double to 12 million individuals. One of the causes is a lifestyle that makes individuals less physically active. Lifestyle changes in dietary patterns from traditional to modern diets are also a major factor in the increasing prevalence of diabetes mellitus (3). An unhealthy lifestyle can cause the accumulation of blood glucose levels and has the potential to become a serious problem in the long term (4).

The global prevalence of diabetes has experienced a significant increase, from 7% in 1990 to 14% in 2022, with the number of sufferers estimated to reach more than 800 million adults (5). Indonesia itself is recorded as the country with the fifth-highest number of diabetes cases in the world, with an estimated 20.4 million adult sufferers (prevalence of 11.3%) in 2024. Based on data from the 2024 Basic Health Research (Riskesdas), the prevalence of Diabetes Mellitus (DM) among the population aged ≥ 15 years in Indonesia was recorded at 11.3% (Riskesdas, 2024). The number of people with Diabetes Mellitus in Central Java Province in 2023 reached 624,082 individuals, slightly increasing compared to the estimated number of sufferers in 2021, which was 618,546 individuals, of whom 91.5% had received appropriate health services (6). According to the Government Agency Performance Report (LKjIP) of the Sukoharjo Health Office in 2023, this number increased to 17,568 cases, reflecting a consistent upward trend from the previous year (Dinkes Sukoharjo, 2024).

Lifestyle can be classified into two types, namely healthy lifestyle and unhealthy lifestyle. Proper nutrition, daily exercise, and adequate sleep are the three foundations of a healthy lifestyle. Lifestyle has a significant impact on a person's physical, mental, and social well-being (7). An unhealthy lifestyle can include poor dietary patterns, the habit

of consuming sweet foods and beverages, lack of physical activity, smoking, and never checking blood glucose levels (8). An unhealthy lifestyle can cause the accumulation of blood glucose levels and has the potential to become a serious problem in the long term (4). Some examples of diseases that may arise include diabetes mellitus, heart disease, and hypertension (9).

Research conducted by Qifti et al. (2020) revealed that as many as 48% of adolescents aged 16 years and 16.4% of adolescents aged 15 years are at risk of developing diabetes mellitus. This condition indicates the need for early prevention efforts to reduce risk factors, considering the negative impacts caused by the disease. Research conducted by Mawar (2023) showed that cafeteria behavior is significantly associated with body mass index (BMI) in adolescents, with a p-value <0.05. Research conducted by Dyah et al. (2019) stated that adolescents remain at risk of developing type 2 diabetes mellitus even without a family history. This risk is mainly influenced by poor dietary patterns, low physical activity, and environmental factors. Consumption of fast food high in calories and fat, as well as a less active lifestyle, can increase the risk of obesity and metabolic disorders, which are the main factors causing type 2 diabetes mellitus.

A preliminary study conducted at SMA Negeri 2 Sukoharjo showed that most students have habits of consuming foods high in sugar and fat, lack of physical activity, and irregular sleep patterns. Based on interviews with eight students, it was found that the majority were not aware of the risks of these lifestyle habits to their health, including the potential of developing diabetes at a young age. These findings prove that adolescents, especially high school students, have begun to show lifestyle patterns that are at risk for non-communicable diseases, including diabetes mellitus. This is very important considering that adolescence is a transitional phase toward adulthood that greatly determines the formation of long-term habits and lifestyles.

Based on the background above, the researcher is interested in conducting a study entitled "Analysis of Diabetes Mellitus Risk Factors with Lifestyle at SMA Negeri 2 Sukoharjo."

Method

This study used a quantitative design with a cross-sectional approach. The measurement of the independent variable, namely lifestyle, and the dependent variable in the form of diabetes mellitus risk factors was carried out simultaneously at one time without researcher intervention. The study population consisted of all eleventh-grade students of SMA Negeri 2 Sukoharjo totaling 303 students. The sample was determined using the Slovin formula with an error level of 10%, resulting in 75 respondents. Respondent selection was conducted using purposive sampling based on inclusion criteria (aged 16–17 years, enrolled in grade XI, and willing to become respondents) and exclusion criteria (suffering from chronic diseases, not completing the questionnaire completely, or not participating in the study until completion).

The research instruments consisted of a demographic characteristics questionnaire (age, sex, body mass index, blood pressure, and family history of diabetes) and a lifestyle questionnaire consisting of 20 items covering dietary patterns, physical activity, smoking habits, and sleep patterns. The instruments had undergone validity testing (calculated $r \geq 0.361$) and reliability testing (Cronbach's Alpha = 0.921) and were therefore declared feasible for use.

The implementation of the study was carried out in three stages, namely: (1) preparation, including obtaining research permits, selecting respondents, and providing informed consent; (2) data collection through questionnaire completion and anthropometric and blood pressure measurements; and (3) evaluation, including checking questionnaire completeness, data

processing, and result tabulation. Data were analyzed univariately to describe the frequency distribution and percentage of each variable, and bivariately using the Spearman Rank test to determine the relationship between lifestyle and diabetes mellitus risk factors. Results were considered significant at a p-value < 0.05. This study obtained ethical approval from the Research Ethics Committee of RS Moewardi and written consent from the respondents.

Result

3.1 Univariate Analysis

Table 1 Frequency Distribution of Respondents' Characteristics

<i>Code</i>	<i>Respondent Characteristics</i>	<i>F(n)</i>	<i>Percentage (%)</i>
<i>Age</i>			
1	16 Years	38	50.7
2	17 Years	37	49.3
Total		75	100
<i>Gender</i>			
1	Male	19	25.3
2	Female	56	74.7
Total		75	100
<i>Body Mass Index</i>			
1	Underweight	23	30.7
2	Normal	45	60.0
3	Overweight	7	9.3
4	Obesity	-	-
Total		75	100
<i>Blood Pressure</i>			
1	Normal	45	60.0
2	Prehypertension	30	40.0
3	Hypertension	-	-
Total		75	100
<i>History DM</i>			
1	Yes	27	36.0
2	No	48	64.0
Total		75	100

This study involved 75 eleventh-grade students of SMA Negeri 2 Sukoharjo. Based on the age distribution, most respondents were 16 years old (50.7%), while the remaining were 17 years old (49.3%). The majority of respondents were female (74.7%), while males accounted for 25.3%. Nutritional status based on body mass index (BMI) showed that most respondents were in the normal category (60.0%), followed by underweight (30.7%) and overweight (9.3%). No respondents were found to be obese.

Most respondents had normal blood pressure (60.0%), while the remaining were in the prehypertension category (40.0%). No respondents had hypertension. Based on family history, 36.0% of respondents had a history of diabetes mellitus, while 64.0% did not have such a history. In terms of lifestyle, 60.0% of respondents had a negative lifestyle (high risk), while 40.0% had a positive lifestyle (low risk).

Table 2. Frequency Distribution of Lifestyle

<i>Gaya Hidup</i>	<i>F</i>	<i>%</i>
Positive	30	40.0
Negative	45	60.0
Total	75	100

The results of the analysis showed that the majority of respondents had a negative lifestyle (60.0%), while only 40.0% of respondents practiced a positive lifestyle. This indicates that most adolescents have not implemented healthy lifestyle behaviors, particularly in aspects of dietary patterns, physical activity, sleep patterns, and smoking habits.

3.2 Bivariate Analysis

Table 3. Cross-tabulation of Age and Lifestyle

Table 1: Cross-Tabulation of Age and Lifestyle							
Variable		Age					
		16 Years		17 Years		Total	
		n	%	n	%	n	%
Lifestyle	Positive	18	24	12	16	30	40
	Negative	20	26,7	25	33,3	45	60
Total		38	50,7	37	49,3	75	100

Spearman Rank, p-value=0,192 Rho=0,152

Based on the cross-tabulation results between lifestyle and age, respondents aged 16 years with a positive lifestyle totaled 18 people (24%), while those with a negative lifestyle totaled 20 people (26.7%). Respondents aged 17 years with a positive lifestyle totaled 12 people (16%), while those with a negative lifestyle totaled 25 people (33.3%). The results of the Spearman correlation test showed that there was no relationship between lifestyle and age at the research location, with a p-value = 0.192 and a weak strength of association, namely Rho = 0.152.

Table 4. Cross-tabulation of Gendre and Lifestyle

Table 1: Cross-tabulation of Gender and Lifestyle							
Variable		Gendre					
		Male		Female		Total	
		n	%	n	%	n	%
Lifestyle	Positive	12	16	18	24	30	40
	Negative	7	9,3	38	50,7	45	60
Total		19	25.3	56	74.7	75	100

Spearman Rank , p-value=0,017 Rho=0,275

Based on the cross-tabulation table of the relationship between lifestyle and diabetes mellitus risk factors at SMA Negeri 2 Sukoharjo in 2025, it can be seen that male respondents with a positive lifestyle totaled 12 people (16%), while male respondents with a negative lifestyle totaled 7 people (9.3%). Female respondents with a positive lifestyle totaled 18 people (24%), while those with a negative lifestyle totaled 38 people (50.7%).

Based on the results of the Spearman rank correlation, there was a relationship between lifestyle and sex among students of SMA Negeri 2 Sukoharjo, with a p-value = 0.017 and a weak strength of association, namely $Rho = 0.275$

Table 5. Cross-tabulation of Body Mass Index and Lifestyle

Variablle		Indeks Massa Tubuh							
		Underweight		Normal		Overweight		Total	
		n	%	n	%	n	%	n	%
Lifesyle	Positive	16	21.3	12	16.0	2	2,7	30	40
	Negative	7	9.3	33	44.0	5	6.7	45	60
Total		23	30.7	45	60.0	7	9.3	75	100

Spearman Rank, p-value=0,001 Rho=0,365

Based on the cross-tabulation table of the relationship between lifestyle and BMI (Body Mass Index), it can be seen that the majority of respondents with a positive lifestyle were mostly in the underweight category, totaling 16 respondents (21.3%), followed by the normal category with 12 respondents (16.0%) and the overweight category with 2 respondents (2.7%). Respondents with a negative lifestyle were in the underweight nutritional status category totaling 7 respondents (9.3%), the normal category totaling 33 respondents (44.0%), and the overweight category totaling 5 respondents (6.7%).

The results of the Spearman statistical test showed that there was a significant relationship between lifestyle and BMI among students of SMA Negeri 2 Sukoharjo, with a p-value = 0.001 and a weak strength of association, namely $Rho = 0.365$.

Table 6. Cross-tabulations of Blood Pressure and Lifestyle

Variable		Tekanan Darah					
		Normal	Prehipertensi	Total	n %	n %	n %
Lifestyle	Positive	26	34,7	4	5,3	30	40
	Negative	19	25,3	26	34,7	45	60
Total		45	60	30	40	76	100

Spearman Rank, p-value=0,000 Rho=0,444

Based on the cross-tabulation table of the relationship between lifestyle and blood pressure, it can be seen that 26 respondents (34.7%) with a positive lifestyle had normal blood pressure and 4 respondents (5.3%) had prehypertension. There were 19 respondents (25.3%) with a negative lifestyle who had normal blood pressure and 26 respondents (34.7%) who had prehypertension.

Based on the results of the Spearman correlation, there was a relationship between lifestyle and blood pressure among students of SMA Negeri 2 Sukoharjo, with a p-value = 0.000 and a moderate strength of association, namely Rho = 0.444.

Table 7. Cross-tabulation of History of Diabetes Mellitus and Lifestyle

		History DM					
Variable		Yes		No		Total	
		n	%	n	%	n	%
Lifestyle	Positif	23	30,7	7	9,3	30	40
	Negatif	4	5.3	41	54.7	45	60
Total		27	36.0	48	64.0	75	100
Spearman Rank, p-value=0,000							
Rho=0,692							

Based on the cross-tabulation table between lifestyle and history of diabetes mellitus, 23 respondents (30.7%) with a positive lifestyle had a family history of diabetes, and 7 respondents (9.3%) did not have a history or family history of diabetes. Meanwhile, 4 respondents (5.3%) with a negative lifestyle had a history or family history of diabetes, and 41 respondents (54.7%) did not have a history or family history of diabetes.

The results of the statistical test using the Spearman test showed that there was a relationship between lifestyle and history of diabetes among students of SMA Negeri 2 Sukoharjo, with a p-value = 0.000 and a strong strength of association, namely Rho = 0.692.

Table 8. Multiple Logistic Regression Test

Coefficients ^a				
		Unstandardized Coefficients	Standardized Coefficients	
		Model	Std. Error	Beta Sig.
1	(Constant)	.205		.352
	Gender	.134	-.015	.898
	Body Mass Index	.099	.055	.652
	Blood Pressure	.086	.268	.003
	History of Diabetes	.092	.609	.000

Based on the results of the multiple linear regression test, the history of diabetes variable had the highest Beta value (0.609) and a significance value of p = 0.000. This indicates that a history of diabetes is the most dominant factor influencing the dependent variable in this study. The blood pressure variable also showed a significant relationship with the dependent variable, with a Beta value = 0.268 and p = 0.003. Meanwhile, sex and body mass index did not have a significant effect on lifestyle because they had p-values > 0.0

Discussion

a. Age

Based on the results of the study, it was found that most respondents were 16 years old (50.7%). The Spearman statistical test with a p-value = 0.192 and Rho = 0.152 indicated that there was no significant relationship between age and adolescent lifestyle ($p > 0.05$). Adolescents in the age range of 15–17 years tend to have similar lifestyle patterns because the influence of the school and family environment is more dominant than the age factor itself (Pratama, 2020).

According to Sani et al. (2023), age affects the risk and incidence of diabetes mellitus, as age is closely related to increased blood glucose levels. The age group that has a risk of developing diabetes mellitus is above 30 years, due to anatomical, physiological, and biochemical changes. A similar statement was also emphasized by Hidayah et al. (2023), who stated that age is not a dominant factor in a healthy lifestyle; instead, internal motivation and other external factors play a more important role. Research by Harnanik (2022) stated that although adolescents are in a phase of cognitive development toward adulthood, the implementation of a healthy lifestyle remains low if it is not accompanied by sufficient knowledge and awareness.

b. Gendre and Lifestyle

Based on the results of the study, the majority of respondents were female, totaling 56 people (74.7%). The results of the Spearman test showed that there was a significant relationship between lifestyle and sex, with a p-value of 0.017 and a Rho value of 0.275. Fernandez (2020) stated that females generally show a higher preference for sweet foods and beverages compared to males, both from biological and psychological perspectives.

The results of a study by Choiriyah (2020) conducted at SMA Negeri 1 Ungaran showed a relationship between sex and unhealthy eating habits; the study found that female adolescents consumed more high-sugar foods and skipped breakfast more often. Another study by Sakdiyah (2023) in Malang City also showed that male adolescents had better exercise habits than females, while female adolescents tended to spend more time on sedentary activities such as watching television and using gadgets.

c. BMI and Lifestyle

Based on the results of the study, it was found that as many as 45 respondents (60.0%) had normal body weight. Statistical testing showed that there was a significant relationship between lifestyle and BMI status, with a p-value = 0.001 and Rho = 0.365. According to Briawan (2022), lifestyle factors including unhealthy dietary patterns, minimal physical activity, and unhealthy habits such as staying up late and consuming fast food can cause an imbalance between energy intake and energy expenditure, which ultimately affects body weight and BMI.

These results are supported by a study by Sari (2025) involving 108 tenth-grade adolescents, which found a significant relationship between dietary patterns and nutritional status (BMI), with a Rho value = 0.394 and a p-value = 0.004, indicating a moderate correlation and a meaningful relationship between lifestyle and nutritional status.

d. Blood Pressure and Lifestyle

Based on the results of the study, out of a total of 76 respondents, 45 respondents had normal blood pressure. The statistical test results showed a p-value = 0.000 and a Spearman correlation coefficient (Rho) = 0.444, indicating a significant relationship with a moderate

correlation strength between lifestyle and blood pressure. Respondents with habits of consuming low-salt and low-fat foods, exercising regularly, and having good sleep quality tended to have normal blood pressure. In contrast, respondents who frequently consumed foods high in sodium, rarely engaged in physical activity, and had habits of staying up late were at a higher risk of experiencing increased blood pressure. These results indicate that behaviors forming daily lifestyle contribute significantly to blood pressure conditions in adolescents.

Theoretically, light physical activity and unbalanced dietary patterns increase the risk of hypertension, because lack of movement leads to decreased elasticity of blood vessels and increased peripheral resistance (Indriani et al., 2023). This is in line with research conducted by Ramadhani et al. (2020), which found that poor dietary patterns were significantly associated with increased systolic and diastolic blood pressure in adolescents ($p = 0.000$). According to Briawan (2022), lifestyle factors including unhealthy dietary patterns, minimal physical activity, and unhealthy habits such as staying up late and consuming fast food can cause an imbalance between energy intake and energy expenditure, which ultimately affects body weight and BMI.

e. History of Diabetes and Lifestyle

The results of this study showed that there was a very significant relationship between lifestyle and history of diabetes mellitus (DM) among adolescents, with a p -value of 0.000 and a correlation coefficient (Rho) of 0.692. Individuals with a family history of diabetes mellitus have a greater likelihood of developing type 2 diabetes mellitus (19). According to Sani et al. (2023), the longer a person suffers from DM, the greater the risk of experiencing complications. Complications due to DM may include disorders of blood vessels, both macrovascular and microvascular, as well as disorders of the nervous system or neuropathy.

The results of a study by Nugraha et al. (2024) stated that a family history of DM increases the risk of type 2 DM, especially when combined with an unhealthy lifestyle such as poor dietary habits and lack of physical activity. Research conducted by Putri et al. (2020) emphasized that a family history of DM ($p = 0.043$) and poor dietary patterns ($p = 0.006$) were proven to increase the risk of type 2 DM, highlighting the importance of genetic and nutritional aspects in the prevention of this disease.

Conclusion

The characteristics of respondents in this study showed that the majority were 16 years old, totaling 38 respondents (50.7%). The majority of respondents were female, totaling 56 respondents (74.7%). Based on BMI, most respondents were in the normal category, totaling 45 respondents (60.0%). Based on blood pressure, the majority were in the normal category, totaling 45 respondents (60%). In terms of history of diabetes, the majority of respondents did not have a history of diabetes, totaling 48 respondents (64.0%). The majority of adolescents at SMA Negeri 2 Sukoharjo had a negative lifestyle, totaling 45 respondents (60%).

There was no significant relationship between lifestyle and age among adolescents, as evidenced by a p -value = 0.192 and $R = 0.152$. There was a relationship between lifestyle and sex, as evidenced by a p -value = 0.017 and $R = 0.275$. There was a significant relationship between lifestyle and BMI, as evidenced by a p -value = 0.001 and $R = 0.365$. There was a relationship between lifestyle and blood pressure, as evidenced by a p -value = 0.000 and $R = 0.444$, and there was also a relationship between lifestyle and history of diabetes, as evidenced by a p -value = 0.000

and $R = 0.692$. The history of diabetes variable had a p -value = 0.000 and a regression coefficient of 0.609, indicating a significant and the most dominant influence on lifestyle.

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