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THE RELATIONSHIP BETWEEN LIFESTYLE AND HYPERTENSION INCIDENCE IN STUDENTS OF KERTA CENDEKIA VOCATIONAL SCHOOL, SIDOARJO REGENCY

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ABSTRACT

Introduction: Hypertension in adolescents is defined as blood pressure ≥130/85 mmHg and may persist into adulthood if not addressed early. Lifestyle factors such as dietary patterns, sleep duration, smoking habits, and family history of disease are believed to play an important role. This study aimed to analyze the relationship between these factors and the incidence of hypertension among students. **Methods:** This study employed a cross-sectional design with a sample of 60 students selected using simple random sampling. Independent variables included dietary patterns (healthy/unhealthy), sleep duration (<7 hours or ≥7 hours per day), smoking habits (yes/no), and family history of disease (present/absent). The dependent variable was the incidence of hypertension. Data were collected using questionnaires and blood pressure measurements, then analyzed using the Spearman rho test. **Results:** Significant associations were found between dietary patterns (p<0.002), sleep duration (p<0.001), smoking habits (p<0.001), and family history of disease (p<0.001) with the incidence of hypertension. The majority of students with unhealthy dietary patterns (60%) and sleep duration <7 hours (58.3%) experienced hypertension. **Conclusion:** Unhealthy lifestyle behaviors and genetic factors play a significant role in the development of hypertension among adolescents. Therefore, school-based health promotion and preventive interventions should be optimized from an early age.

Keywords: adolescent hypertension, diet, lifestyle, sleep patterns, smoking.

HUBUNGAN ANTARA GAYA HIDUP DAN KEJADIAN HIPERTENSI PADA SISWA SMK KERTA CENDEKIA KABUPATEN SIDOARJO

ABSTRAK

Pendahuluan: *Pendahuluan: Hipertensi pada remaja didefinisikan sebagai tekanan darah ≥130/85 mmHg dan berisiko berlanjut hingga dewasa apabila tidak ditangani sejak dini. Faktor gaya hidup seperti pola makan, pola tidur, kebiasaan merokok, serta riwayat penyakit keluarga diduga berperan penting. Penelitian ini bertujuan menganalisis hubungan faktor-faktor tersebut dengan kejadian hipertensi pada siswa.* ***Metode:*** *Penelitian ini menggunakan desain cross sectional dengan sampel 60 siswa yang dipilih melalui simple random sampling. Variabel independen meliputi pola makan (sehat/tidak sehat), pola tidur (durasi <7 jam atau ≥7 jam per hari), kebiasaan merokok (ya/tidak), dan riwayat penyakit keluarga (ada/tidak). Variabel dependen adalah kejadian hipertensi. Data dikumpulkan menggunakan kuesioner dan pengukuran tekanan darah, kemudian dianalisis menggunakan uji Spearman rho.* ***Hasil:*** *Terdapat hubungan bermakna antara pola makan (p<0,002), pola tidur (p<0,001), kebiasaan merokok (p<0,001), serta riwayat penyakit keluarga (p<0,001) dengan kejadian hipertensi. Mayoritas siswa dengan pola makan tidak sehat (60%) dan durasi tidur <7 jam (58,3%) mengalami hipertensi.* ***Kesimpulan:*** *Gaya hidup tidak sehat dan faktor genetik berperan*

signifikan terhadap hipertensi pada remaja, sehingga intervensi promotif dan preventif berbasis sekolah perlu dioptimalkan sejak dini.

Kata kunci: *gaya hidup, hipertensi remaja, merokok, pola makan, pola tidur.*

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INTRODUCTION

Hypertension is no longer limited to being a health problem in adulthood, but is increasingly found in younger age groups. The World Health Organization (WHO, 2023) reports that the number of people with hypertension globally has nearly doubled since 1990, reaching around 1.3 billion people in 2019, with the majority of cases coming from low- and middle-income countries. The WHO emphasizes that lifestyle factors established at a young age, such as excessive salt consumption, lack of physical activity, and smoking, play an important role in the acceleration of hypertension, even though global data still focuses largely on the adult population.

In Indonesia, hypertension is becoming a real threat to adolescents. The Indonesian Ministry of Health's Health Policy and Development Agency reports that young people are at significant risk of developing hypertension, mainly due to increasingly common unhealthy lifestyles, such as smoking, lack of sleep, and consumption of fast food and foods high in salt (Humas BKPK, 2024; Puspa, 2025). This condition indicates a shift in the epidemiology of hypertension to younger age groups and has the potential to increase the burden of cardiovascular disease in the future.

Adolescence is a critical phase in the formation of healthy behaviors, during which eating habits, sleep patterns, and risky behaviors such as smoking begin to take hold. In addition to lifestyle factors, family medical history, such as hypertension or heart disease, also contributes as a non-modifiable factor that increases adolescents' susceptibility to hypertension. The combination of behavioral and genetic factors makes adolescents a strategic group for early prevention efforts.

Therefore, this study aims to analyze the relationship between lifestyle, including diet, sleep duration, smoking habits, and family medical history, with the incidence of hypertension in adolescent students, as a

basis for strengthening school- and family-based promotive and preventive interventions.

METHODS

This study used a cross-sectional design to analyze the relationship between lifestyle and the incidence of hypertension in adolescents. The study population consisted of all 71 students at SMK Kerta Cendekia in Sidoarjo Regency. A sample size of 60 students was determined using the Slovin formula and selected using simple random sampling, so that each member of the population had an equal chance of becoming a respondent.

The independent variables in this study were lifestyle factors, including diet, sleep patterns, smoking habits, and family medical history, while the dependent variable was the incidence of hypertension. Dietary patterns are defined as daily food consumption habits, particularly foods high in salt and fat, which are categorized as healthy or unhealthy based on the frequency of consumption of fast food and foods high in salt ≥3 times per week (WHO, 2023). Sleeping patterns were measured based on the duration of nighttime sleep, with categories of sufficient (≥7 hours/day) and insufficient (<7 hours/day) according to the recommendations of the National Sleep Foundation (Bauducco et al., 2016). Smoking habits were defined as cigarette smoking in the past 30 days and categorized as smoking and non-smoking (Sreeramareddy et al., 2024). Family medical history was determined based on the presence of immediate family members with a history of hypertension or cardiovascular disease.

Hypertension was determined by measuring blood pressure using a sphygmomanometer, then classified based on the guidelines of the WHO and the International Society of Hypertension (ISH), namely blood pressure categorized as normal (<130/85 mmHg) and hypertension (≥130/85 mmHg) in adolescents (Verdecchia et al., 2020). Data were collected using structured questionnaires and blood pressure measurement observation sheets. Data analysis was performed using Spearman's rho test to determine the relationship between lifestyle variables and the incidence of hypertension, with a significance level of $p < 0.05$.

RESULTS

Table 1. Characteristics of respondents based on gender and age

Respondent Characteristics	Frequency (n)	Percentage (%)
Gender		
Male	30	50
Female	30	50
Age		
16	23	38.3
17	21	35.0
18	16	26.7
Total	**60**	**100**

Based on Table 1 above, it is known that the characteristics of respondents based on gender are equal, namely 30 adolescents (50%) each, and the distribution of respondents based on age is highest at 16 years old with 23 adolescents (38%) and lowest at 18 years old with 16 adolescents (26.7%).

Table 2. Characteristics of respondents based on diet, sleep rest patterns, smoking habits and family history of disease

Respondent Characteristics	Frequency (n)	Percentage (%)
Diet		
Not Healthy	36	60
Healthy	24	40
Sleep Pattern		
< 7 hours	35	58.3
≥ 7 hours	25	41.7
Smoking Habit		
Smoking	14	23.3
Not Smoking	46	76.7
Family History of Disease		
Available	40	66.7
None	20	33.3

Based on Table 2, it is known that most students have unhealthy eating patterns, namely 36 respondents (60%). This condition shows that the majority of adolescents in this study still tend to consume foods high in salt, fat, and fast food, which has the potential to increase the risk of hypertension from an early age. Meanwhile, only 24 respondents (40%) have implemented a healthy diet.

In terms of sleep patterns, more than half of the respondents, namely 35 students (58.3%), slept less than 7 hours per day. This finding indicates that sleep deprivation is a fairly dominant problem among students and can have an impact on physiological regulation disorders, including increased blood pressure. Conversely, 25 students (41.7%) had a sleep duration in line with recommendations, which could potentially have a protective effect on cardiovascular health.

Regarding smoking habits, most respondents did not smoke, namely 46 students (76.7%). However, the proportion of students who smoke is still significant, namely 14 students (23.3%). This figure shows that nearly a quarter of adolescents have been exposed to risky behaviors that can increase blood pressure and contribute to hypertension, especially among male adolescents.

Based on family medical history, 40 respondents (66.7%) had a family history of diseases such as hypertension, diabetes mellitus, or other cardiovascular diseases. This high proportion indicates that most students are in the non-modifiable risk group, making them more susceptible to hypertension. This condition emphasizes the importance of early screening and family-based preventive approaches in efforts to reduce the risk of hypertension in adolescents.

Table 3. Characteristics of respondents based on weight and height

Respondent Characteristics	Mean	Median	Std. Dev	Min	Max
Body Weight	67.20	67.00	7.858	53	85
Height	167.03	166.00	5.102	160	178
Mean Arteri Pressure	96.61	95.33	8.44	83.33	116

Based on Table 3, the anthropometric characteristics of the respondents show that the average weight of students is 67.20 kg with a median value of 67.00 kg. The weight range was between 53 kg and 85 kg, with a standard deviation of 7.858. This value illustrates that there was considerable variation in weight among the respondents, which may reflect differences in nutritional status and body composition. This variation in weight has the potential to affect blood pressure, given that excess weight is an important risk factor for hypertension in adolescents.

The average height of respondents was 167.03 cm with a median of 166.00 cm, a standard deviation of 5.102, and a height range of 160 cm to 178 cm. The relatively close mean and median values indicate a fairly symmetrical height distribution. This variation in height is important to note because blood pressure classification in adolescents is influenced by age, gender, and height, so differences in height can affect the interpretation of respondents' blood pressure status.

For the variable of mean arterial pressure, the average value was 96.61 mmHg with a median of 95.33 mmHg. The minimum mean arterial pressure recorded was 83.33 mmHg and the maximum was 116 mmHg, with a standard deviation of 8.44. This range of values indicates that some respondents had relatively high blood pressure, suggesting a tendency toward increased blood pressure in certain groups of students. These findings reinforce the importance of monitoring blood pressure from adolescence, especially in students with risk factors related to anthropometric characteristics.

Table 4. Bivariate analysis of factors associated with the incidence of hypertension in adolescents

Characteristics	Incidence of Hypertension in Adolescents						Statistical Test
	Hypertension		Normal		Total		
	n	%	n	%	n	%	
Diet							
Unhealthy	**18**	**30**	**18**	**30**	**36**	**60**	**P < 0.002**
Healthy	**3**	**5**	**21**	**35**	**24**	**40**	
Sleep Pattern							
< 7 hours	**21**	**35**	**14**	**23.3**	**35**	**58.3**	**P < 0.001**
≥ 7 hours	**0**	**0**	**25**	**41.7**	**25**	**41.7**	
Smoking Habit							
Smoking	**11**	**18.3**	**3**	**5**	**14**	**23.3**	**P< 0.001**
No Smoking	**10**	**16.7**	**36**	**60**	**46**	**76.7**	
Family History of Disease							**P < 0.001**
Yes	**21**	**35**	**19**	**31.7**	**40**	**66.7**	
None	**0**	**0**	**20**	**33.3**	**20**	**33.3**	

Based on table 4 above based on dietary risk factors, adolescents who do not experience hypertension or normal tensions by applying a healthy diet dominate as many as 21 adolescents (35%). The results of the Spearman Rho test showed an association between diet and the incidence of hypertension in adolescents with a P value < 0.002, where the P value is less than alpha (0.05) as the limit of significance.

In addition, based on the factor of adolescent sleep patterns, there were 21 adolescents (35%) who had a sleep pattern of less than 7 hours experiencing hypertension, while 14 adolescents (23.3%) who had a sleep pattern ≥ 7 hours did not experience hypertension. The results of the Spearman Rho statistical test show that the P value < 0.001 which is smaller than the alpha value of 0.05 which is used as the limit of significance, so it can be concluded that there is a relationship between sleep patterns and the incidence of hypertension in adolescents.

Regarding the smoking habit factor, it was found that 11 teenagers (18.3%) who experienced hypertension had a smoking habit, while 36 teenagers (60%) did not experience hypertension and did not have a smoking habit. According to the results of the Spearman rho statistical test, it was found that the P value < 0.001 where the P value was smaller than alpha (0.05) so it can be concluded that there is a relationship between adolescents' sleep rest patterns and the incidence of hypertension.

Based on family disease history factors which include a history of hypertension, diabetes mellitus and other heart diseases, it is known that 21 adolescents (35%) have or have a history of disease in their family. While 20

adolescents (33.3%) did not experience hypertension because there was no family history of the disease.

DISCUSSION

1. The Relationship Between Lifestyle, Diet, and Hypertension Among Students

Adolescents are in a phase of rapid growth that requires sufficient energy and nutrients to support their physical activity and biological development. However, the transition to a modern lifestyle in adolescents is often accompanied by an unbalanced diet. Statistical test results show a significant relationship between diet and the incidence of hypertension in students ($p < 0.002$). This finding is reinforced by the distribution of respondents, where the proportion of hypertension is much higher in students with unhealthy diets (30%) than in students with healthy diets (5%). This difference shows that diet quality plays an important role in the formation of hypertension risk from school age.

These findings reflect the condition of adolescents in urban and semi-urban areas of Indonesia, including Sidoarjo Regency, who are increasingly exposed to foods high in salt, fat, and fast food. The preference for salty, fatty, and commercially labeled foods reflects a shift in adolescent consumption patterns due to ease of access, media influence, and a lack of control and nutrition education in schools and families. According to Prisylvia et al., (2022), changes in lifestyle, particularly long-term unhealthy eating habits, are the main factors contributing to nutritional problems among adolescents, including an increased risk of non-communicable diseases.

This study also shows that the majority of respondents (60%) still practice unhealthy eating patterns, indicating low implementation of preventive diets for hypertension among adolescents. Andriani et al., (2024) reported that adolescents tend to consume branded foods, and excessive consumption of fast food can have an impact on adolescent health, namely obesity, which can increase the risk factors for hypertension, diabetes, cancer, heart disease, and stroke. Similar findings were reported by Pamungkas et al., (2024) in Lumajang, East Java, showing that high sodium intake and fast food consumption are significantly correlated with increased blood pressure in adolescents.

Physiologically, adolescents who have eating patterns that are closer to a healthy diet (low-salt diet, lots of vegetables, fiber-rich fruits) tend to have a lower risk of high blood pressure. Consumption of foods high in sodium can significantly increase blood volume through sodium and water retention,

thereby increasing blood pressure (Nugraha et al., 2019; Rahimi et al., 2020).

Therefore, diet is the most easily modified lifestyle factor for the prevention of early hypertension, especially through education on balanced nutrition and salt restriction. In addition, unhealthy dietary patterns among adolescents are an important modifiable factor for adolescent hypertension. Thus, dietary patterns are the most strategic lifestyle factor to modify through school-based interventions, such as balanced nutrition education, salt intake restriction, and the creation of a healthy cafeteria environment, in order to reduce the risk of hypertension from adolescence onwards.

2. The Relationship Between Lifestyle, Sleep Patterns, and Hypertension in Students

Sleeping is a period of rest and is often considered an unproductive activity. Sleep is a condition in which the body and mind function to restore themselves. A good sleep pattern will ensure that a person's bodily functions work properly. Sleeping for too long is not good, and conversely, sleeping for too short a period is also not good. A person needs quality sleep for emotional health, behavior, and cell growth or repair, including in adolescents.

The results of the analysis showed that there was a significant relationship between sleep patterns and hypertension (P<0001). There were 21 adolescents (35%) who slept less than 7 hours and had hypertension, while none of the adolescents who slept ≥ 7 hours had hypertension. This shows that short sleep contributes significantly to increased blood pressure in adolescents. The results of this study also show that 58.3% (35 students) of adolescents slept less than 7 hours/day, while 41.7% (25 students) slept ≥ 7 hours/day. Based on this data, more than half of the respondents were in the insufficient sleep category. This could be a significant factor in the prevalence of hypertension in adolescents. Poor sleep quality can affect hormonal regulation, oxidative stress, and parasympathetic system activity, all of which are mechanisms involved in increasing a person's blood pressure.

In the local context, adolescent sleep patterns are influenced by various factors, such as using electronic devices late into the night, busy academic activities, and a lack of education about sleep hygiene in schools and families. This condition is in line with the findings of Surya et al., (2022), who stated that poor sleep patterns can disrupt physiological and psychological balance, including increased sympathetic nervous system activity and decreased parasympathetic dominance, which leads to an increase in blood pressure. Additionally,

sleep deprivation is associated with increased stress hormones (cortisol), oxidative stress, and endothelial dysfunction, which are important mechanisms in the pathogenesis of hypertension.

The results of this study are in line with the American Heart Association (2025) statement that adolescents who sleep less than 7.7 hours have an almost threefold risk of developing high blood pressure compared to adolescents who get enough sleep. This risk increases to five times higher in adolescents with a combination of insufficient sleep and insomnia. Conversely, adolescents who report insomnia but still get sufficient sleep do not show a significant increase in the risk of hypertension. This confirms that sleep duration plays a more dominant role than subjective sleep complaints in the risk of hypertension in adolescents.

These conditions may explain that inadequate sleep patterns are a significant and contextually relevant lifestyle factor in the development of hypertension among students. Promotive interventions in the form of time management education, limiting the use of electronic devices before bedtime, and creating a school environment that supports healthy sleeping habits are important strategies in preventing hypertension from adolescence onwards.

3. The Relationship Between Lifestyle, Smoking Habits, and Hypertension Among Students

The results of this study show that 23.3% (14 students) smoke and 76.7% (46 students) do not smoke. This indicates that nearly a quarter of students already have a smoking habit, in other words, that exposure to risky behavior in the school environment is still strong. The figure of 23.3% of adolescents who smoke indicates a significant contribution to the incidence of hypertension. However, it may not be as significant as the sleep patterns and dietary patterns of adolescents. Smoking among adolescents is no longer a marginal phenomenon, but a public health issue that has the potential to contribute to an increase in the incidence of hypertension from an early age. This is due to the conditions in the research area/region. Cigarettes are very accessible and affordable for adolescents. On the other hand, the social environment of these adolescents normalizes smoking among males, and peer influence further reinforces this habit.

Smoking habits play an important role as a modifiable risk factor for hypertension through various physiological mechanisms, including vasoconstriction due to nicotine, increased heart rate, activation of the sympathetic nervous system, and increased oxidative stress that affects endothelial dysfunction. The results

of this study are in line with Zhang et al., (2019), who explained that active smoking has a more direct effect on adolescents than on adults. The impact of active smoking on blood pressure tends to be more pronounced in adolescents than in adults because the cardiovascular system of adolescents is still developing and is more vulnerable to exposure to toxic substances in cigarettes. Exposure to parental cigarette smoke in adolescents, known as passive smoking, and environmental smoke can increase blood pressure in children and adolescents. Huntington-Moskos et al., (2014) also stated that both active smoking and exposure to cigarette smoke (passive smoking) combined with obesity can increase systolic blood pressure variance.

When examined by gender, the prevalence of smoking is higher among male adolescents than females. This contributes to hypertension in males with high incidence rates. Alnasser et al., (2022) showed that male adolescents have almost twice the risk of developing hypertension compared to females due to smoking habits and higher exposure to psychosocial stress. Physiologically, the hormone estrogen in females also provides a protective effect against increased blood pressure by improving endothelial function and reducing arterial stiffness (Alnasser et al., 2022). Thus, hormonal differences and smoking behavior between males and females may explain the variation in the incidence of hypertension among adolescents.

Overall, smoking habits among adolescents, especially males, are an important preventable determinant of hypertension. Therefore, strengthening smoke-free policies in schools, gender-based health education, and family involvement in controlling exposure to tobacco are crucial strategies in reducing the risk of hypertension among adolescents.

4. The Relationship Between Lifestyle, Family Medical History, and Hypertension Incidence in Students

The results of the study show that 40 students (66.7%) had a family history of disease (hypertension, diabetes mellitus, stroke), while 20 students (33.3%) did not. These data indicate that non-modifiable risk factors dominate in the adolescent population studied, placing the majority of students in a group that is biologically more susceptible to increased blood pressure. The high prevalence of family history indicates that the tendency for hypertension in adolescents is not solely triggered by current behavior, but also by genetic predisposition that has been established from an early age.

These findings are consistent with the research conducted by Zhao et al., (2021) in China, which showed that adolescents with a positive family history, especially when

accompanied by obesity, have a much higher risk of hypertension than adolescents without such a history. Tozo et al., (2022) stated that adolescents aged 11-17 years with a family history of disease were correlated with higher blood pressure. Physiologically, genetic factors play a role in the regulation of the renin-angiotensin-aldosterone system, sodium sensitivity, and endothelial function, all of which contribute to susceptibility to hypertension.

A total of 66.7% of adolescents in this study had a family history of disease. The existence of a family history of disease confirms that genetic factors are non-modifiable factors that play a major role in the occurrence of hypertension in adolescents. Many students with high blood pressure have parents who also suffer from hypertension or heart disease, indicating that genetic factors also play a role in adolescent hypertension. This condition increases the likelihood of exposure to multiple risk factors in adolescents, both through genetic inheritance and through a family environment that does not support healthy living behaviors, such as a high-salt diet or smoking habits at home.

Strategies for preventing hypertension should not only focus on individual behavior but should also consider screening and intervention in adolescent families, such as providing family education about smoking habits within the family and their impact, or material about controlling genetic risk factors for hypertension in adolescents. Thus, these findings confirm that hypertension prevention in adolescents cannot focus solely on individual behavioral changes, but needs to be expanded to a family-based approach.

CONCLUSION

The results of the study show that there is a significant relationship between a person's lifestyle and the number of hypertension cases among students. There are several factors that increase the risk of hypertension in adolescents, including unhealthy eating patterns, consumption of foods high in salt and fat, lack of sleep (less than 7 hours), and smoking, especially among adolescent males. Genetic factors originating from parents with a history of hypertension also increase the likelihood of children developing similar diseases.

This study has several limitations. The cross-sectional design does not allow for tracing the causal relationship between lifestyle and hypertension. Blood pressure measurements were taken at a single point in time, so they do not describe blood pressure variations longitudinally. Other variables that could potentially affect blood pressure, such as physical activity, nutritional status, psychological stress levels, and exposure to the family

environment, have not been analyzed in depth.

The next study should use a longitudinal design in order to observe the causal relationship between adolescent lifestyles, such as eating patterns, sleeping hours, and smoking habits, and periodic changes in blood pressure. In addition, a more in-depth analysis is needed, taking into account other variables such as physical activity, nutritional status, psychological stress levels, and family environmental factors in order to better understand the causes of hypertension in adolescents. The use of repeated blood pressure measurements and validation through biochemical testing can also improve the accuracy of results and strengthen the scientific evidence in efforts to prevent hypertension from an early age.

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