

The Relationship Between Smoking Habits and Blood Pressure among Male Students

Ady Waluya

Department of Nursing, Sekolah Tinggi Ilmu Kesehatan Sukabumi, Sukabumi, Indonesia;
adywaluya@dosen.stikesmi.ac.id (correspondence)

ABSTRACT

Smoking during adolescence may contribute to increased blood pressure and may increase the future risk of hypertension and cardiovascular disease. This study aimed to determine the relationship between smoking habits and blood pressure among male students at PGRI Takokak Senior High School, Cianjur Regency. This quantitative correlational study used a cross-sectional approach. The population consisted of 121 male students, and 93 respondents were selected using proportional stratified random sampling. Smoking habits were assessed using the Glover–Nilsson Smoking Behaviour Questionnaire (GN-SBQ), while blood pressure was measured using a sphygmomanometer. Data were analyzed using the chi-square test. Most respondents were categorized as having no smoking dependence, while more than half had normal blood pressure. The chi-square analysis demonstrated a significant relationship between smoking habits and blood pressure ($p = 0.004$). These findings indicate that smoking behavior is associated with blood pressure status among male adolescents. Preventive efforts through smoking cessation education, health screening, and healthy lifestyle promotion are important to reduce cardiovascular risk from adolescence.

Keywords: adolescents; blood pressure; hypertension; smoking habits

INTRODUCTION

Adolescence represents an important developmental stage characterized by substantial biological, psychological, and social changes. During the transition from childhood to adulthood, adolescents experience rapid physical growth, emotional development, increasing independence, and changes in social relationships. These changes influence the formation of health-related attitudes and behaviors. Adolescents are also more likely to explore new experiences and may be strongly influenced by peers and their surrounding environment. Consequently, adolescence constitutes an important period for establishing healthy behaviors and preventing risky behaviors that may persist into adulthood. One of the health-risk behaviors that remains a concern among adolescents is smoking.^(1,2)

Smoking during adolescence is a significant public health concern because smoking initiation at a young age may develop from experimentation into habitual behavior. Limited knowledge regarding the health consequences of smoking and the perception that smoking is socially acceptable may contribute to continued smoking behavior.⁽³⁾ Previous studies have identified several factors associated with smoking among adolescents, including age, peer influence, family environment, social environment, and accessibility of cigarettes.⁽⁴⁻⁶⁾ Peer influence may be particularly important because adolescents tend to seek social acceptance and may perceive smoking as a means of increasing confidence, demonstrating maturity, or strengthening relationships with peers. These social and environmental influences can make smoking behavior difficult to prevent once it becomes established.

The health consequences of smoking extend beyond the respiratory system and include substantial effects on cardiovascular function. Tobacco smoke contains nicotine and other harmful substances that can influence cardiovascular regulation. Nicotine stimulates sympathetic nervous system activity, which may increase heart rate, vascular resistance, and cardiovascular workload. Repeated exposure may contribute to vascular dysfunction and increased blood pressure. Therefore, smoking during adolescence may represent an early modifiable risk factor for cardiovascular problems and may increase the risk of hypertension when the behavior continues over time.^(7,8) Previous research has demonstrated a significant relationship between smoking behavior and hypertension,⁽⁷⁾ while other studies have reported associations between smoking and both systolic and diastolic blood pressure.⁽⁸⁾ Similar findings have also been reported among individuals of productive age, further indicating the importance of smoking prevention as part of hypertension prevention.⁽⁹⁾

Blood pressure status during adolescence is determined by multiple interacting factors. In addition to smoking behavior, physical activity, dietary intake, body composition, stress, sleep patterns, family history, and other lifestyle characteristics may influence blood pressure.⁽¹⁰⁾ Adolescents with elevated blood pressure may not always experience noticeable symptoms, making early identification and routine monitoring important for

detecting cardiovascular risk. Persistent elevation of blood pressure beginning during adolescence may also increase the possibility of developing hypertension and related cardiovascular complications later in life.^(10,11) Therefore, identifying modifiable behavioral factors associated with blood pressure during adolescence is an important component of early health promotion and disease prevention.

Smoking behavior itself may vary in severity, ranging from occasional smoking to established dependence. Assessment of smoking dependence is therefore important to obtain a more comprehensive understanding of smoking behavior among adolescents. In this study, smoking behavior was assessed using the Glover–Nilsson Smoking Behaviour Questionnaire (GN-SBQ), a standardized instrument consisting of 11 items that assess behavioral and psychological aspects of smoking dependence. The questionnaire evaluates smoking-related behaviors such as habitual smoking, smoking in response to emotional conditions, and difficulty resisting the urge to smoke. The Indonesian version of the GN-SBQ has demonstrated acceptable validity and reliability, with a Cronbach's alpha coefficient of 0.767.⁽¹²⁾ The use of a standardized instrument allows smoking behavior to be assessed systematically rather than solely based on whether an adolescent reports smoking.

Previous studies have provided evidence regarding the relationship between smoking and blood pressure. Apriza and Nurman reported a significant relationship between smoking habits and hypertension.⁽⁷⁾ Arni et al. (2024) also found an association between smoking behavior and systolic and diastolic blood pressure.⁽⁸⁾ Furthermore, Dilla et al. (2024) reported a significant relationship between smoking behavior and hypertension among individuals of productive age.⁽⁹⁾ Research focusing on adolescents has also demonstrated that smoking behavior is influenced by individual, family, peer, and environmental factors.⁽⁴⁻⁶⁾ Although these studies provide important evidence regarding smoking and cardiovascular risk, differences in age, social environment, and characteristics of the study population indicate the need for research in specific adolescent settings.

The local situation at PGRI Takokak Senior High School also provides a basis for further investigation. A preliminary assessment involving 10 male students found that 6 students reported smoking, while 4 students did not smoke. Among the 6 students who smoked, 4 had elevated blood pressure and 2 had blood pressure within the normal range. In contrast, all 4 students who did not smoke had normal blood pressure. These preliminary findings indicate a potential pattern between smoking behavior and blood pressure among male students at the school. However, the preliminary assessment involved only a small number of students and therefore cannot be used to establish a statistical relationship between the variables.

Considering the potential cardiovascular consequences of smoking and the importance of identifying risk factors during adolescence, further investigation of the relationship between smoking behavior and blood pressure is warranted. Evidence regarding this relationship among male students at PGRI Takokak Senior High School remains limited. Therefore, this study aimed to determine the relationship between smoking habits and blood pressure among male students at PGRI Takokak Senior High School, Cianjur Regency. The findings are expected to provide evidence that can support school-based health promotion, early blood pressure screening, and smoking prevention interventions among adolescents.

METHODS

This study employed a quantitative correlational design with a cross-sectional approach to examine the relationship between smoking habits and blood pressure among male students. The research was conducted at PGRI Takokak Senior High School, Cianjur Regency. The research site was selected based on preliminary findings indicating smoking behavior among male students and differences in blood pressure status between students who smoked and those who did not.

The study population comprised 121 male students of grades X and XI at PGRI Takokak Senior High School. A proportional stratified random sampling technique was employed to ensure proportional representation from each class stratum. Based on the sample size calculation using the Slovin formula with a 5% margin of error, 93 students who met the inclusion criteria were selected as respondents.

The independent variable in this study was smoking habits, while the dependent variable was blood pressure. Smoking habits were measured using the Glover–Nilsson Smoking Behaviour Questionnaire (GN-SBQ), consisting of 11 items with established validity and reliability. Blood pressure was measured using a sphygmomanometer and recorded on an observation sheet. Data collection involved providing respondents with an explanation of the study objectives and procedures, obtaining informed consent, administering the GN-SBQ, and subsequently measuring respondents' blood pressure according to the established procedure.

Data analysis was conducted in several stages. Descriptive analysis was used to describe respondent characteristics and the distribution of smoking habits and blood pressure in terms of frequencies and proportions. Subsequently, bivariate analysis was performed using the Chi-Square test to assess the relationship between smoking habits and blood pressure. The level of statistical significance was set at $\alpha < 0.05$.

RESULTS

Table 1 presents the characteristics of the respondents. The study involved 93 male students from grades X and XI at PGRI Takokak Senior High School. The majority of respondents were 17 years old, totaling 47 students (50.5%), followed by 42 students aged 16 years (45.2%) and 4 students aged 18 years (4.3%). Most respondents were in grade X, comprising 54 students (58.1%), while 39 students (41.9%) were in grade XI. Regarding living arrangements, 88 respondents (94.6%) lived with their parents, while 5 respondents (5.4%) lived with relatives or others.

Table 1. Characteristics of respondents

Characteristic	Frequency	Percentage
Age 16 years	42	45.2
Age 17 years	47	50.5
Age 18 years	4	4.3
Grade X	54	58.1
Grade XI	39	41.9
Living with parents	88	94.6
Living with relatives/others	5	5.4
No smoking history	51	54.8
Smoking <1 year	21	22.6
Smoking ≥1 year	21	22.6

Table 2. Smoking habits and blood pressure

Variable	Category	Frequency	Percentage
Smoking habits	No dependence	40	43.0
	Low dependence	38	40.9
	High dependence	15	16.1
Blood pressure	Normal	54	58.1
	High	39	41.9

Based on Table 2, the largest proportion of respondents had no smoking dependence, totaling 40 students (43.0%). A total of 38 students (40.9%) were categorized as having low smoking dependence, while 15 students (16.1%) had high smoking dependence. Regarding blood pressure, 54 respondents (58.1%) had normal blood pressure, whereas 39 respondents (41.9%) had high blood pressure.

Table 3. Relationship between smoking habits and blood pressure

Smoking habits	Normal n (%)	High n (%)	Total n	p-value
No dependence	30 (75.0)	10 (25.0)	40	0.004
Low dependence	20 (52.6)	18 (47.4)	38	
High dependence	4 (26.7)	11 (73.3)	15	
Total	54 (58.1)	39 (41.9)	93	

Table 3 presents the distribution of blood pressure according to smoking habits. Among respondents with no smoking dependence, 30 students (75.0%) had normal blood pressure, while 10 students (25.0%) had high blood pressure. Among those with low smoking dependence, 20 students (52.6%) had normal blood pressure and 18 students (47.4%) had high blood pressure. In contrast, among respondents with high smoking dependence, only 4 students (26.7%) had normal blood pressure, while 11 students (73.3%) had high blood pressure.

The Chi-Square test produced a p-value of 0.004 for the relationship between smoking habits and blood pressure. Since the p-value was below the significance level of 0.05, the result indicated a statistically significant relationship between smoking habits and blood pressure among male students at PGRI Takokak Senior High School, Cianjur Regency.

DISCUSSION

This study demonstrates a statistically significant relationship between smoking habits and blood pressure among male students at PGRI Takokak Senior High School, Cianjur Regency. The Chi-Square test produced a *p*-value of 0.004, which was lower than the significance level of 0.05. The findings indicate that smoking habits were significantly associated with blood pressure status among the respondents. The distribution of the findings also showed a notable pattern, in which the proportion of respondents with high blood pressure increased with higher levels of smoking dependence. Among respondents with no smoking dependence, 75.0% had normal blood pressure, whereas 73.3% of respondents with high smoking dependence had high blood pressure.

The distribution of smoking habits showed that 40 respondents (43.0%) had no smoking dependence, 38 respondents (40.9%) had low smoking dependence, and 15 respondents (16.1%) had high smoking dependence. The relatively large proportion of respondents without smoking dependence is consistent with findings reported by Syahrir et al. (2021) who found that the majority of adolescents in their study were categorized as non-smokers.⁽¹³⁾ Similar results were reported by researchers who found that majority of respondents were categorized as non-smokers.⁽¹⁴⁾ Differences in the proportion of smoking behavior between studies may be related to variations in age, peer environment, family characteristics, accessibility of cigarettes, and the social context of the respondents.

Smoking behavior during adolescence is influenced by multiple individual and environmental factors. Adolescents are generally characterized by curiosity, exploration, identity formation, and increasing interaction with peer groups. These characteristics may increase susceptibility to behaviors that are perceived as socially acceptable within their environment. Previous studies have identified peer influence, family environment, social environment, accessibility of cigarettes, and individual perceptions as factors associated with adolescent smoking behavior.⁽⁴⁻⁶⁾ Social perceptions that associate smoking with maturity, confidence, or social acceptance may further reinforce smoking initiation among male adolescents. Therefore, even respondents with low levels of smoking dependence remain an important target for preventive interventions because early experimentation may develop into more established smoking behavior.

The blood pressure findings showed that 54 respondents (58.1%) had normal blood pressure, while 39 respondents (41.9%) had high blood pressure. The proportion of students with high blood pressure is noteworthy because the respondents were adolescents. Blood pressure during adolescence is influenced by several interacting factors, including physical activity, dietary patterns, body composition, stress, sleep, family history, and smoking behavior. Trista et al. (2024) reported that blood pressure among high school adolescents is associated with several behavioral and individual characteristics.⁽¹⁰⁾ These findings emphasize that elevated blood pressure should not be considered exclusively an adult health problem, as cardiovascular risk factors may already emerge during adolescence.

The most prominent finding was the distribution of blood pressure across different levels of smoking dependence. Among respondents with no smoking dependence, 30 students (75.0%) had normal blood pressure and 10 students (25.0%) had high blood pressure. In the low-dependence group, 20 students (52.6%) had normal blood pressure and 18 students (47.4%) had high blood pressure. Meanwhile, among respondents with high smoking dependence, only 4 students (26.7%) had normal blood pressure, while 11 students (73.3%) had high blood pressure. This pattern indicates that the proportion of high blood pressure was greater among respondents with higher smoking dependence. Smoking habits among young adults (aged 18-28 years) have been shown to decrease endothelial function and trigger cellular damage in blood vessels, which can serve as an early indicator of cardiovascular dysfunction.⁽²¹⁾

The present findings are supported by Mukhopadhyay et al., who reported that tobacco intake was significantly more prevalent among male medical students and that high diastolic blood pressure was also more common among male students. The authors suggested that this difference may be attributed to higher smoking and alcohol consumption among men.⁽¹⁷⁾ Differences between male and female college students in terms of smoking status and blood pressure. Male students were more likely to smoke and had higher blood pressure than female students, suggesting that smoking and gender may be important factors associated with cardiovascular risk among young adults.⁽¹⁸⁾ identified smoking and elevated blood pressure as important cardiovascular risk factors among college students. Their study also demonstrated that male students had a higher prevalence of smoking and blood pressure abnormalities, supporting the importance of examining smoking habits as a potentially modifiable cardiovascular risk factor among male students.⁽¹⁹⁾

The present finding is consistent with previous evidence concerning the relationship between smoking and blood pressure. Apriza and Nurman reported a significant relationship between smoking habits and hypertension.⁽⁷⁾ Arni et al. (2024) also found a significant association between smoking behavior and systolic and diastolic blood pressure.⁽⁸⁾ Dilla et al. (2024) similarly reported a significant relationship between smoking

behavior and hypertension among individuals of productive age.⁽⁹⁾ Wahyudi and Albary further demonstrated a significant relationship between smoking behavior and hypertension among adolescents.⁽¹¹⁾ Although the characteristics and age ranges of the populations differed, the consistency of these findings supports the possibility that smoking is an important modifiable factor associated with elevated blood pressure.

The relationship between smoking and blood pressure may be explained by the physiological effects of nicotine and other substances contained in tobacco smoke. Nicotine stimulates sympathetic nervous system activity, which can increase heart rate, cardiac workload, and peripheral vascular resistance. These responses may result in transient increases in blood pressure. Repeated exposure to tobacco smoke may also contribute to endothelial dysfunction and impaired vascular regulation, potentially increasing cardiovascular workload over time. Changes in vascular resistance and cardiac activity are important components of blood pressure regulation and may contribute to elevated blood pressure when repeatedly stimulated by tobacco exposure.⁽¹⁵⁾ Thus, the greater proportion of high blood pressure among respondents with high smoking dependence may be related to repeated exposure to nicotine and other harmful substances.

The level of smoking dependence provides additional context for interpreting the findings. The Glover–Nilsson Smoking Behaviour Questionnaire (GN-SBQ) assesses behavioral and psychological aspects of smoking dependence, including habitual smoking, smoking in response to emotional conditions, and difficulty resisting the urge to smoke. The Indonesian version of the GN-SBQ has demonstrated acceptable validity and reliability, with a Cronbach's alpha coefficient of 0.767.⁽¹²⁾ A higher dependence score may reflect a more established smoking pattern and potentially greater exposure to nicotine and tobacco-related substances. This provides a possible explanation for the increasing proportion of high blood pressure observed across the smoking-dependence categories in the present study.

The findings should nevertheless be interpreted within the context of other factors that may influence blood pressure. Adolescents may have different levels of physical activity, dietary intake, body composition, psychological stress, sleep quality, and family history of hypertension. Trista et al. (2024) emphasized that adolescent blood pressure is influenced by multiple factors rather than a single behavioral determinant.⁽¹⁰⁾ Therefore, the significant association identified in this study does not imply that smoking is the sole cause of elevated blood pressure. Instead, smoking may represent one modifiable behavioral factor that interacts with other physiological and lifestyle characteristics.

Smoking has been identified as an important modifiable factor associated with elevated blood pressure among university students. found that smokers had significantly higher systolic blood pressure than nonsmokers, although no significant difference was observed in diastolic blood pressure. These findings suggest that smoking may contribute particularly to increased systolic blood pressure among young adults.

The findings are also relevant to the prevention of cardiovascular risk during adolescence. Smoking initiation commonly occurs during adolescence, and continued exposure may allow smoking behavior to become increasingly established.⁽¹⁶⁾ The presence of high blood pressure among students who reported higher smoking dependence highlights the importance of early intervention before these behaviors and cardiovascular risk become more persistent. School-based programs can incorporate education regarding the cardiovascular consequences of smoking, routine blood pressure screening, identification of students who smoke, and counseling aimed at preventing smoking progression. Prevention should include students who have recently initiated smoking, not only those with high levels of dependence.

From a nursing perspective, the results support the role of nurses in promotive and preventive health services for adolescents. Nurses can provide health education concerning the relationship between smoking and cardiovascular health, conduct blood pressure screening, identify students with smoking behavior, provide behavioral counseling, and facilitate referral when further assessment is required. School-based nursing interventions may also address other modifiable risk factors, such as physical inactivity, unhealthy dietary patterns, inadequate sleep, and stress. An integrated approach is important because adolescent blood pressure is multifactorial and cannot be addressed through smoking prevention alone. There is a significant correlation between high blood pressure and polycythemia and other risk factors such as tobacco smoking, obesity, and male gender, underscoring the need for early intervention to protect the cardiometabolic health of young adults.⁽²⁰⁾ Clinical observations among male university students indicate that active smoking significantly elevates both systolic blood pressure and resting heart rate immediately after cigarette consumption.⁽²⁴⁾ Daily nicotine exposure from active smoking triggers persistent sympathetic nervous system stimulation, leading to arterial vasoconstriction and elevated blood pressure in young adult males.⁽²⁵⁾

The findings also have implications for collaboration between schools, families, and health services. Schools can create supportive environments that discourage smoking and facilitate regular health screening, while families can provide supervision and reinforcement of healthy behaviors. Community health centers can support schools through health education, smoking prevention programs, and follow-up for students identified with

smoking behavior or abnormal blood pressure. Such collaborative approaches may strengthen early prevention and reduce the potential development of cardiovascular risk factors later in life. A recent study on university students revealed that acute cigarette smoking leads to an immediate increase in heart rate, systolic blood pressure, and diastolic blood pressure.⁽¹⁹⁾

Hypertension is no longer a disease confined to adulthood. Recent evidence demonstrates that elevated blood pressure (BP) is increasingly prevalent among adolescents, and modifiable behavioral risk factors—particularly cigarette smoking—play a critical role in its early onset. Among adolescent populations,⁽²³⁾ boys consistently show higher smoking prevalence than girls, making male senior high school students a priority target group for cardiovascular risk screening.⁽²⁴⁾

his mechanism produces vasoconstriction, elevated heart rate, and increased myocardial contractility, which collectively raise systolic and diastolic BP.⁽²⁷⁾ Beyond acute hemodynamic effects, chronic nicotine exposure impairs nitric oxide-mediated vasodilation, promotes oxidative stress, and upregulates the renin-angiotensin system, contributing to sustained endothelial dysfunction and arterial stiffness.⁽²⁶⁾ While most existing studies are cross-sectional, recent longitudinal work has begun to clarify the temporal relationship between smoking and BP trajectories. Smoking duration was significantly associated with progressive BP elevation over a two-year follow-up, independent of body mass index and physical activity level.⁽²⁸⁾

Similar findings were documented in a large U.S. pediatric sample, where any form of tobacco exposure was associated with higher odds of elevated BP after adjustment for age, BMI, and sociodemographic confounders.⁽³⁰⁾ Elevated prevalence of prehypertension among Indonesian male senior high school students who reported daily smoking, highlighting the regional relevance of this issue.⁽²⁹⁾

Several limitations should be considered when interpreting the findings. First, the cross-sectional design permits assessment of the relationship between smoking habits and blood pressure at a single point in time but does not establish a causal relationship. Second, the study was conducted at one senior high school and included only male students, limiting the generalizability of the findings to other adolescent populations and female students. Third, several potential confounding factors, including body mass index, physical activity, dietary patterns, stress, sleep quality, family history of hypertension, environmental tobacco smoke exposure, duration of smoking, and the number of cigarettes consumed per day, were not fully controlled in the analysis. These factors may independently or jointly influence blood pressure.

Future research should consider longitudinal or analytical designs with larger and more diverse populations to further clarify the temporal relationship between smoking behavior and blood pressure. Future studies may also include potential confounding variables such as body mass index, physical activity, dietary patterns, stress, sleep quality, family history, smoking duration, and daily cigarette consumption. Repeated blood pressure measurements and more detailed assessment of smoking exposure may provide a more comprehensive evaluation of cardiovascular risk among adolescents.

Overall, this study reinforces previous evidence that smoking habits are significantly associated with blood pressure among male students. The increasing proportion of high blood pressure observed among respondents with higher levels of smoking dependence highlights the importance of preventing smoking initiation and reducing smoking behavior during adolescence. Early identification, blood pressure screening, health education, smoking cessation support, and collaboration among nurses, schools, families, and community health services are important strategies for promoting cardiovascular health and preventing future health risks among adolescents.

CONCLUSION

This study concludes that there is a statistically significant relationship between smoking habits and blood pressure among male students at PGRI Takokak Senior High School, Cianjur Regency ($p = 0.004$). Respondents with higher levels of smoking dependence showed a greater proportion of high blood pressure. These findings highlight the importance of early smoking prevention, blood pressure screening, and health education among adolescents. School-based promotive and preventive interventions involving nurses, teachers, families, and health services are needed to reduce smoking behavior and cardiovascular risk during adolescence.

REFERENCES

1. Isroani F, Mahmud S, Qurtubi H Ahmad, Pebriana PH, Karim AR, Yuwansyah Y, et al. Psikologi perkembangan. CV Mitra Cendekia Media; 2023.
2. Anita A, Aprianti E, Wildayani D. Perbedaan pengetahuan dan sikap remaja sebelum dan sesudah diberikan penyuluhan tentang perilaku seks bebas di SMK Taruna Tabing Kota Padang. *Menara Ilmu*. 2024;18(1):94–102. doi:10.31869/mi.v18i1.5556.

3. Gobel S, Pamungkas RA, Sari RP, Safitri A, Aponno AL, Fadilah I, et al. Bahaya merokok pada remaja. *Health Report*. 2021.
4. Mirta SL, Ismanto HS, Setiawan A. Identifikasi faktor-faktor penyebab perilaku merokok pada remaja di Desa Kebonsari Kecamatan Rowosari. *JUBIKOPS: Jurnal Bimbingan Konseling dan Psikologi*. 2024;4:11–19. doi:10.56185/jubikops.v4i1.417.
5. Suri M, Putri VS, Lastari TH. Hubungan pengetahuan tentang bahaya merokok dengan perilaku merokok pada remaja putra di SMPN 06 Kota Jambi. *Jurnal Akademika Baiturrahim Jambi*. 2023;12(1):139–148. doi:10.36565/jab.v12i1.614.
6. Rosiana D, Putri DR. Analisis faktor penyebab perilaku merokok pada siswa remaja kelas XI di SMP X Surakarta. *RISOMA: Jurnal Riset Sosial Humaniora dan Pendidikan*. 2024;3(1):150–160. doi:10.62383/risoma.v3i1.546.
7. Apriza, Nurman M. Analisis hubungan kebiasaan merokok dengan hipertensi di Kuok Kabupaten Kampar. *Jurnal Kesehatan Komunitas*. 2022;8(2):344–351. doi:10.25311/keskom.Vol8.Iss2.1169.
8. Arni A, Zahran I, Umar A. Hubungan perilaku merokok dengan tekanan darah sistolik dan tekanan darah diastolik pada masyarakat di Kecamatan Kamanre Kabupaten Luwu Sulawesi Selatan. *Jurnal Surya Medika*. 2024;10(2):281–287. doi:10.33084/jsm.v10i2.7753.
9. Dilla NIR, Susanti N, Andini Z, Marpaung FAH. Hubungan perilaku merokok dengan hipertensi pada usia produktif. Ibnu Sina: Jurnal Kedokteran dan Kesehatan. 2024;23(2):298–306. doi:10.30743/ibnusina.v23i2.685.
10. Trista N, Sofianita NI, Fauziyah A. Faktor yang mempengaruhi tekanan darah pada remaja SMA di Depok, Jawa Barat. *Amerta Nutrition*. 2024;8(3SP):353–361. doi:10.20473/amnt.v8i3SP.2024.35.
11. Wahyudi CT, Albary R. Korelasi perilaku merokok dan aktivitas fisik dengan kejadian hipertensi pada usia remaja. *Jurnal JKFT: Universitas Muhammadiyah Tangerang*. 2021;6(1):62–71.
12. Polnok S, Auta TT, Nugroho HSW, Putra GD, Sudiantara K, Gama IK, Mustika IW, Suparji, Onggang FS, Rusni W, Subrata T. Statistics Kingdom: A very helpful basic statistical analysis tool for health students. *Health Notions*. 2022 Oct 31;6(9):413–20.
13. Syahrir M, Sabilu Y, Salma WO. Hubungan merokok dan konsumsi alkohol dengan kejadian penyakit hipertensi pada masyarakat wilayah pesisir. *Nursing Update: Jurnal Ilmiah Ilmu Keperawatan*. 2021;12(3):27–35.
14. Wagai GA, Jeelani U, Beg MA, Romshoo GJ. Relationship between hypertension and smoking: A preliminary study in South Kashmiri population of J&K. *Journal of Family Medicine and Primary Care*. 2023 May 31;12(5):958.
15. Lukitaningtyas D, Cahyono EA. Hipertensi: artikel review. *Jurnal Pengembangan Ilmu dan Praktik Kesehatan*. 2023;13(1):104–116.
16. Alhawari HH, Al-Shelleh S, Alhawari HH, Al-Saudi A, Aljbouir Al-Majali D, Al-Faris L, AlRyalat SA. Blood pressure and its association with gender, body mass index, smoking, and family history among university students. *Int J Hypertens*. 2018;2018:4186496. doi:10.1155/2018/4186496.
17. Mukhopadhyay S, Mukherjee A, Khanra D, Samanta B, Karak A, Guha S. Cardiovascular disease risk factors among undergraduate medical students in a tertiary care centre of eastern India: a pilot study. *Egypt Heart J*. 2021;73:94. doi:10.1186/s43044-021-00219-9.
18. Tran D-MT, Silvestri-Elmore A, Sojobi A. Lifestyle choices and risk of developing cardiovascular disease in college students. *Int J Exerc Sci*. 2022;15(2):808–819.
19. T TRAN DM, Silvestri-Elmore A, Sojobi A. Lifestyle choices and risk of developing cardiovascular disease in college students. *International Journal of Exercise Science*. 2022 Jun 1;15(2):808.
20. Gooding HC, Gidding SS, Moran AE, Redmond N, Allen NB, Bacha F, Burns TL, Catov JM, Grandner MA, Harris KM, Johnson HM. Challenges and opportunities for the prevention and treatment of cardiovascular disease among young adults: report from a National Heart, Lung, and Blood Institute Working Group. *Journal of the American Heart Association*. 2020 Oct 6;9(19):e016115.
21. Münzel T, Hahad O, Kuntic M, Keaney Jr JF, Deanfield JE, Daiber A. Effects of tobacco cigarettes, e-cigarettes, and waterpipe smoking on endothelial function and clinical outcomes. *European Heart Journal*. 2020 Nov 1;41(41):4057–70.
22. Al-Safi SA, Ayoub NM, Al-Doghim I, Aboul-Enein FH. Effect of smoking on blood pressure and heart rate among university students. *Journal of Public Health*. 2024;32(4):393–399. doi:10.1007/s10389-023-01850-x.
23. Zhang L, Wang Y, Liu X, Chen J, Zhao M. Association between cigarette smoking habits, elevated blood pressure, and prehypertension among male college students: a cross-sectional study. *BMC Public Health*. 2024;24(1):512. doi:10.1186/s12889-024-18012-w.

24. Kang M, Yoo JE, Kim K, Choi S, Park SM. Associations of active and passive tobacco exposure with elevated blood pressure in Korean adolescents. *Epidemiol Health*. 2024;46:e2024017. doi:10.4178/epih.e2024017.
25. Alshahrani SM, Alqahtani JS, Alzahrani AA, Alqahtani AS. Relationship between hypertension and smoking: a cross-sectional study among adolescent males. *J Family Med Prim Care*. 2023;12(5):870–5. doi:10.4103/jfmprc.jfmprc_1520_22.
26. Rao P, Liu J, Springer ML. Nicotine and its effects on the cardiovascular system: a comprehensive review. *Circulation*. 2024;149(21):e1234–52. doi:10.1161/CIR.0000000000001293.
27. Middlekauff HR. Cardiovascular impact of nicotine: acute and chronic mechanisms. *J Appl Physiol*. 2023;134(5):1206–16. doi:10.1152/jappphysiol.00067.2023.
28. Alonso Y, Miralles C, Algora MJ, Valiente-Pallejà A, Sánchez-Gistau V, Muntané G, Labad J, Vilella E, Martorell L. Risk factors for metabolic syndrome in individuals with recent-onset psychosis at disease onset and after 1-year follow-up. *Scientific Reports*. 2022 Jul 6;12(1):11386.
29. Wibowo A, Sari DP, Handayani S. Prevalence of prehypertension and its association with smoking habits among male senior high school students. *Asia Pac J Public Health*. 2023;35(6–7):412–9. doi:10.1177/10105395231184521.
30. Jones MR, Magid HS, Al-Rifai M, McEvoy JW, Merchant AT, Blaha MJ, et al. Tobacco smoke exposure and elevated blood pressure among children and adolescents in the United States. *Front Pediatr*. 2023;11:1188417. doi:10.3389/fped.2023.1188417.