P-ISSN: 1412-3746
E-ISSN: 2549-6557

JURNAL KESEHATAN
FAKULTAS KESEHATAN
UNIVERSITAS DIAN NUSWANTORO
Volume 24. No.1, April 2026

Overview and Risk Factors of Hypertension in Students at SMPN 35 Semarang

Muhammad Raffa Mulia Nugroho[1*], Azhar Tegar Aldina[2], Dwi Natasya Rahma Aulya[3], Rubinem[4], Nor Amalia Muthoharoh[5]

[1]Faculty of Health, Universitas Dian Nuswantoro, Jl. Imam Bonjol No. 207, Semarang City, Central Java, Indonesia
[2]UPTD Puskesmas Karangmalang. Jl. RM Soebagiono Tjondro Koesoemo Mijen, Semarang City, Central Java, Indonesia
**Corresponding Author: Muhammad Raffa Mulia Nugroho*
Email: 411202203610@mhs.dinus.ac.id

Received *: 15-01-2026*
Accepted *: 06-03-2026*
Available online by *: 30-04-2026*

Abstract . Hypertension is one of the main risk factors for cardiovascular disease, which has long been associated with adulthood, but in recent years it has been increasingly found in adolescents. This condition is a major concern because hypertension in adolescents is often asymptomatic and has the potential to continue into adulthood. This study aims to describe the incidence of hypertension and its risk factors at SMPN 35 Semarang. This study aims to describe the prevalence of hypertension and its risk factors at SMPN 35 Semarang. The study used a descriptive quantitative method, utilizing secondary data from routine student health screenings obtained from the Semar PKG 79 system and the Sehat Indonesiaku application. Data analysis was performed descriptively and presented in the form of frequency distributions and percentages. The results of the study showed that students with blood pressure above normal, ranging from prehypertension to grade 1 and 2 hypertension, were found in all grade levels. In addition, risk factors that could potentially contribute to increased blood pressure were found, such as low physical activity, the presence of overweight and obesity, and high exposure to cigarette smoke among students. The conclusion of this study indicates that hypertension has emerged since adolescence, thus requiring the strengthening of routine health screening in schools as well as school-based promotive and preventive efforts to prevent noncommunicable diseases from an early age.

Keywords: adolescent, hypertension, screening

INTRODUCTION

Noncommunicable diseases (NCDs) are a global health problem and the leading cause of premature death worldwide. The main NCDs include cardiovascular disease, cancer, diabetes mellitus, and chronic respiratory disease, which are generally associated with behavioral risk factors and unhealthy lifestyles(1) . One of the main risk factors for cardiovascular disease is hypertension, which plays an important role in increasing the risk of stroke and coronary heart disease(2). Hypertension is a condition of elevated blood pressure that often causes no symptoms, making it known as a silent killer. The World Health Organization (WHO) reports that hypertension is a global health problem whose prevalence continues to increase and is a leading cause of premature death worldwide. By 2024, it is estimated that approximately 1.4 billion adults aged 30–79 will have hypertension, or about 33% of the population in that age group, with two-thirds of them living in low- and middle-income countries. The WHO also notes that around 600 million people with hypertension (44%) are unaware of their condition, meaning that many new cases are only detected after serious complications arise, while only 23% of sufferers manage to control their blood pressure optimally(3). In Indonesia, hypertension is also a significant public health problem and is included in the main burden of national NCDs. Based on the 2023 Indonesian Health Survey (SKI), hypertension is recorded as one of the leading causes of death in people aged ≥15 years, with the proportion of people with hypertension aged 18–59 years who are centrally obese being 3.4 times higher than those with hypertension without central obesity. while in the ≥60 age group, the proportion of hypertensive patients with central obesity was relatively the same as those without central obesity(4).

In recent years, hypertension has become increasingly common among adolescents. Lifestyle changes such as high consumption of simple sugars, sweetened beverages, and high-energy snacks, as well as low levels of physical activity, are factors contributing to increased blood pressure in adolescents(5). In addition, nutritional status such as overweight and obesity are important factors that increase the risk of hypertension, along with an increase in Body Mass Index (BMI) which causes disruption to blood vessel regulation and blood pressure(6). In addition, nutritional status such as overweight and obesity are important factors that increase the risk of hypertension, along with an increase in Body Mass Index (BMI) which causes disruption to blood vessel regulation and blood pressure(7)

Smoking is a significant risk factor for hypertension in adolescents because the nicotine in cigarettes stimulates the sympathetic nervous system, increasing heart rate and causing vasoconstriction of blood vessels, which leads to an increase in blood pressure(8). In the long term, smoking causes blood vessel damage, endothelial dysfunction, and increased inflammatory substances that contribute to hypertension(9). Teenagers who smoke are known to have a higher risk of developing hypertension compared to teenagers who do not smoke(9). In addition, adolescence is an important phase in the development of future risks of noncommunicable diseases (NCDs). Various risky behaviors that emerge during adolescence, such as smoking, low physical activity, and unhealthy eating patterns, tend to continue into adulthood and contribute to an increased risk of hypertension and cardiovascular disease in productive age(10).

The selection of the research location was based on the need for a large student population and the availability and completeness of health screening results. SMPN 35 Semarang is the school with the highest number of students compared to other junior high schools in the Karangmalang Community Health Center working area and routinely conducts health screenings with results that are fully documented through the Semar PKG 79 System and the Sehat Indonesiaku application. The screening results showed that there were students with blood pressure in the prehypertension to hypertension category, which provided an initial picture of the incidence of hypertension and its risk factors, particularly nutritional status, physical activity, and smoking behavior.

Based on these conditions, this study was conducted to describe the incidence of hypertension and its associated risk factors among students at SMP 35 Semarang. The results of this study are expected to provide information and a basis for planning hypertension prevention efforts among adolescents in school settings.

METHODS

This study used a descriptive quantitative method utilizing secondary data obtained from the Indonesian Ministry of Health's Digital Health Information System, namely Semar PKG 79 and the Sehat Indonesiaku application. The research subjects were all students of SMPN 35 Semarang aged 12-15 years who participated in routine health screening activities. The number of respondents analyzed in this study was 688 students. Data were collected through routine health screening activities conducted by health workers from the Karangmalang Community Health Center at SMPN 35 Semarang. The variables studied included the dependent variable of blood pressure status, which comprised normal, prehypertension, stage 1 hypertension, and stage 2 hypertension, and the independent variables, which consisted of nutritional status based on Body Mass Index (BMI), level of physical activity, and smoking behavior.

Blood pressure measurements were taken by trained health workers using standard digital sphygmomanometers in accordance with WHO guidelines for blood pressure measurement in adolescents. Nutritional status was determined through anthropometric measurements of weight (kg) and height (cm), which were then calculated as BMI according to age using WHO growth standards for children and adolescents aged 5-19 years. Data on physical activity and smoking behavior were obtained through a structured questionnaire administered during the screening session or extracted from health records stored in the Semar PKG 79 system.

Data analysis was performed descriptively to describe the characteristics of the study population and the distribution of hypertension prevalence and related risk factors. Data were presented in the form of frequency distribution tables and percentages for each variable studied, including blood pressure categories, nutritional status based on BMI according to age, physical activity levels, and smoking behavior among students.

RESULT

This study involved students of SMPN 35 Semarang who participated in routine health screening conducted by the Karangmalang Community Health Center. The data analyzed was secondary data from the health screening of SMPN 35 Semarang students recorded in the Semar PKG 79 system and the Sehat Indonesiaku application. Respondent data included blood pressure status, nutritional status based on Body

Mass Index (BMI) according to age, physical activity level, and smoking behavior of students. The distribution of respondent characteristics was presented in the form of frequency tables and percentages to provide an overview of the students' conditions.

Table 1. Distribution of blood pressure status among students at SMPN 35 Semarang

Variable	Normal	Pre Hipertensi	Hipertensi Grade 1	Hipertensi Grade 2	Total
Class VII	106 (87,6%)	12 (9,9%)	2 (1,7%)	1 (0,8%)	121
Class VIII	177 (97,8%)	4 (2,2%)	0 (0%)	0 (0%)	169
Class IX	148 (87,6%)	10 (5,9%)	10 (5,9%)	1 (0,6%)	181

Referring to Table 1, the majority of students in all grades had normal blood pressure, with the highest percentage found in eighth graders, at 97.8%. However, there were still students with above-normal blood pressure in all grades, ranging from prehypertension to stage 1 and 2 hypertension. The highest percentage of prehypertension was found in seventh graders at 9.9%, while grade 1 hypertension was highest among ninth graders at 5.9%. Grade 2 hypertension was found in a very small proportion of seventh and ninth graders. These findings indicate that blood pressure problems have emerged since junior high school age, even among early grade students.

Table 2. Distribution of Smoking Behavior among Students at SMPN 35 Semarang

Variable	Exposed to Cigarette Smoke	Smokers	Total
Class VII	102 (91,9%)	9 (8,1%)	111
Class VIII	109 (87,2%)	16 (12,8%)	125
Class IX	143 (80,8%)	34 (19,2%)	177

The results in Table 2 show that the proportion of students exposed to cigarette smoke is quite high, far exceeding the number of active smokers. The highest percentage of exposure to cigarette smoke was found in seventh-grade students at 91.9%, while the highest prevalence of active smokers was found in ninth-grade students at 19.2%. These results indicate that students' exposure to cigarettes comes more from their surroundings than from direct smoking behavior. In addition, there appears to be an increase in the prevalence of active smokers as grade levels increase.

Tabel 3. Distribusi tingkat aktivitas fisik siswa SMPN 35 Semarang

Variable	Melakukan aktivitas fisik	Tidak	Total
Class VII	60 (69%)	26 (30,2%)	86
Class VIII	40 (66,7%)	20 (33,3%)	60
Class IX	50 (64,1%)	28 (35,9%)	78

Based on Table 3, most students reported engaging in physical activity, with the highest percentage among seventh graders at 69%. However, there was still a proportion of students who did not engage in physical activity in the last seven days, with the highest percentage found among ninth graders at 35.9%. These findings indicate that there is a group of students who have been sedentary since school age.

Table 4. Distribution of nutritional status of students at SMPN 35 Semarang

Variable	Malnutrition	Undernourishment	Good Nutrition	Overweight	Obesity	Total
Class VII	1 (0,9%)	17 (15,7%)	80 (74,1%)	5 (4,6%)	5 (4,6%)	108
Class VIII	0	28 (17,2%)	116 (71,2%)	12 (7,4%)	7 (4,3%)	163
Class IX	0	5 (4,1%)	109 (90,1%)	3 (2,5%)	4 (3,3%)	121

Based on Table 4, the majority of students had good nutritional status in all grades, with the highest percentage found in ninth graders at 90.1%. However, there were still students with overweight and obesity in every grade. The highest percentage of overweight students was found in eighth graders at 7.4%, while the highest percentage of obese students was also found in eighth graders at 4.3%. These findings indicate that although most students have normal nutritional status, the existence of overweight and obesity remains a potential risk factor for metabolic health disorders, including hypertension.

DISCUSSION

All research data was obtained from the health information system owned by the Semarang City Health Office, namely Semar PKG79. The results of this study indicate that students with above-normal blood pressure, ranging from prehypertension to grade 1 and 2 hypertension, were found in all grade levels. These findings indicate that hypertension has emerged since early adolescence and is no longer limited to the adult age group. This is consistent with local epidemiological evidence from the greater Semarang area, where a study conducted specifically among adolescents in Semarang Regency found that one-third of respondents already exhibited elevated blood pressure, with 6.1% classified as stage 2 hypertension, 12.2% as stage 1, and 15.0% as Pre Hypertension (11). More recently, a study examining determinants of hypertension among adolescents aged 13–18 years in Semarang City using secondary data from the Semarang City Health Office confirmed that hypertension in this age group remains a significant public health concern, with excessive fat consumption identified as the strongest predictor, alongside physical inactivity and excessive salt intake (12). The urgency of early detection is further underscored by evidence that unmanaged hypertension progresses into serious complications in adulthood; a study in Semarang City found that age and family history were significantly associated with hypertension complications, highlighting the long-term consequences of elevated blood pressure that originates early in life (13). In addition, important risk factors such as exposure to cigarette smoke, low physical activity, and overweight and obesity were also found to potentially contribute to increased blood pressure in students.

The discovery of prehypertension and hypertension across all grade levels reinforces the fact that hypertension is a health problem that begins to develop during school age. These results are in line with a World Health Organization (WHO) report which states that increased blood pressure in children and adolescents is increasingly being found, especially in developing countries due to unhealthy lifestyle changes(3). These findings are also consistent with a report by the Indonesian Ministry of Health, which states that hypertension in children and adolescents often goes undetected and tends to increase from year to year(14)

The emergence of above-normal blood pressure in adolescents can be explained through biological mechanisms and physiological development. During adolescence, the blood pressure regulation system is not yet fully stable, making it more sensitive to external factors such as low physical activity, excessive nutritional status, and exposure to addictive substances. The WHO states that exposure to risk factors from a young age can accelerate structural and functional changes in blood vessels that contribute to increased blood

pressure(3). In addition, hypertension in adolescents is often asymptomatic, so it is only identified through health screening activities(14).

Low physical activity and the prevalence of overweight and obesity among some students may be important explanations for the findings of high blood pressure. Low physical activity contributes to decreased blood vessel elasticity and increased peripheral vascular resistance, which directly affects blood pressure. Overweight and obesity also play a role through increased circulating blood volume, insulin resistance, and activation of the renin-angiotensin-aldosterone system, which can increase blood pressure in adolescents(7). Previous studies have shown that adolescents with high BMI have a greater risk of hypertension than adolescents with normal nutritional status(5).

In addition to biological and behavioral factors, the environmental context also plays a role in explaining the results of this study, particularly exposure to cigarette smoke. Home environments and peer groups that are not completely smoke-free may explain the high exposure to cigarettes among students at SMPN 35 Semarang, even though the prevalence of active smokers is relatively low(5). In terms of smoking behavior, the proportion of students exposed to secondhand smoke is higher than that of active smokers. Exposure to secondhand smoke is known to increase blood pressure through stimulation of the sympathetic nervous system and disruption of blood vessel endothelial function(9). This indicates that increased blood pressure occurs not only in active smokers, but also in adolescents who are passively exposed to cigarette smoke(15). The home environment and peer groups that are not entirely smoke-free may explain the high exposure to cigarettes among students at SMPN 35 Semarang.

The findings of this study have important implications for adolescent health promotion and prevention efforts. Routine blood pressure screening in schools needs to be strengthened as an early detection measure for hypertension. The WHO recommends school-based interventions that include increased physical activity, balanced nutrition education, and control of smoke-free environments as strategies for preventing non-communicable diseases in adolescents(3). The use of digital systems such as Semar PKG 79 and the Sehat Indonesiaku app can support more targeted and data-driven adolescent health program planning.

This study has limitations because it uses secondary data, which is limited to variables available in the health information system, and respondents were inconsistent on several variables. In addition, the descriptive research design does not allow conclusions to be drawn about the causal relationship between risk factors and the incidence of hypertension. Data on physical activity and smoking behavior were obtained through questionnaires, which could potentially cause reporting bias among respondents.

Further research is recommended using an analytical design with the addition of variables such as dietary patterns, psychosocial stress levels, and family history of hypertension to obtain a more comprehensive picture(3).

CONCLUSION

This study shows that students at SMPN 35 Semarang have been found to have above-normal blood pressure, ranging from prehypertension to stage 1 and 2 hypertension, across all grade levels. These findings

confirm that hypertension has emerged since adolescence and has the potential to continue into adulthood if prevention and control efforts are not taken early on.

In addition, this study identified risk factors associated with hypertension in students, namely low physical activity, overweight and obesity, and exposure to cigarette smoke, both active and passive. These factors indicate that individual behavior and the environment play an important role in increasing the risk of hypertension in school-age adolescents.

Based on the results of this study, it can be concluded that routine health screening in schools has a strategic role in the early detection of hypertension and its risk factors in adolescents. Therefore, it is necessary to strengthen school-based promotional and preventive efforts through increased physical activity, nutritional status control, and the creation of a smoke-free environment as part of efforts to prevent non-communicable diseases from an early age.

ACKNOWLEDGEMENTS

The author would like to thank the Karangmalang Community Health Center in Semarang for its support and facilitation of the health screening data used in this study. Thanks are also extended to SMPN 35 Semarang for its permission and cooperation in conducting student health screenings. In addition, the author would like to express his appreciation to the Semarang City Health Office for the development and utilization of the Semar PKG 79 health information system, which was the source of data for this study. The author also thanks the Faculty of Health, Public Health Study Program, Dian Nuswantoro University for the academic support, guidance, and facilitation in the implementation and preparation of this research.

REFERENCES

1. World Health Organization. WHO [Internet]. 2025 [cited 2025 Dec 22]. p. 1. Penyakit Tidak Menular. Available from: https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases
2. World Health Organization. Global report on hypertension.
3. World Health Organization. World Health Organization [Internet]. 2025 [cited 2025 Dec 3]. p. 1. Hypertension. Available from: https://www.who.int/news-room/fact-sheets/detail/hypertension
4. Situasi A, Permasalahan dan. Prevalensi , Dampak , serta Upaya Pengendalian Hipertensi & Diabetes di Indonesia. 2023.
5. Agofure O, Odjimogho S, Okandeji-Barry O, Moses V. Dietary pattern and nutritional status of female adolescents in Amai Secondary School, Delta StatAgofure, O. et al. (2021) 'Dietary pattern and nutritional status of female adolescents in Amai Secondary School, Delta State, Nigeria.', The Pan African medi. Pan Afr Med J. 2021;38:32. doi:10.11604/pamj.2021.38.32.15824 PubMed PMID: 33777300.
6. Saputri RK, Al-bari A, Indah R, Pitaloka K. Hubungan Status Gizi dan Aktivitas Fisik dengan Kejadian Hipertensi Remaja. Vol. 10. 10(2):10–9.
7. Merokok HP, Fisik A, Sentral O, Hipertensi K, Tugu P, Semarang K. Media Gizi Ilmiah Indonesia. Vol. 2. 2024;2(3):11–21.
8. Fahmi M, Hamarno R, Hidayah N, Pertami SB. Hubungan Perilaku Merokok Dan Aktivitas Fisik

Dengan Tekanan Darah Pada Remaja. Vol. 1. 2023;1:23–30.

9. Umbas IM. Hubungan Antara Merokok Dengan Hipertensi Di Puskesmas Kawangkoan. Vol. 7. 2019;7.
10. Feng Y, Sun D, Sun X, Guo Q, Zhang J, Li Y. Global burden of noncommunicable diseases attributable to modifiable behavioral risks among adolescents and young adults aged. 2025.
11. Siswanto Y, Ambar Widyawati S, Asyura Wijaya A, Dewi Salfana B, Karlina. Hipertensi pada Remaja di Kabupaten Semarang. Jurnal Penelitian dan Pengembangan Kesehatan Masyarakat Indonesia. 2020 Oct 14;1(1). doi:10.15294/JPPKMI.V1I1.41433
12. Qurbo HZ. Determinan Kejadian Hipertensi pada Remaja (13-18 Tahun) di Kota Semarang Tahun 2023. Higea (Journal of Public Health Research and Development). 2024 Jul 8;8(3):331–43. doi:10.15294/higeia/v8i3/2626
13. Fatmasari AP, Cahyati WH. Karakteristik Demografi Terkait Komplikasi Pada Penderita Hipertensi di Kota Semarang. Visikes. 2021 Oct 12;20(2):270–5. doi:10.33633/Visikes.V20I2.4999
14. Humas Badan Kebijakan Pembangunan Kesehatan. Bahaya Hipertensi Mengintai Anak Muda Indonesia [Internet]. 2024. p. 1. Available from: https://www.badankebijakan.kemkes.go.id/bahaya-hipertensi-mengintai-anak-muda-indonesia/
15. Farabi AF, Revilla G. Artikel Penelitian Hubungan Kebiasaan Merokok dengan Tekanan Darah pada Siswa SMK N 1 Padang. Vol. 6. 2017;6(2):429–34.