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Lifestyle Factors and Hypertension Among Adolescents: A Cross-Sectional Study

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ABSTRACT

Background: Hypertension is an increasing health issue among adolescents and may lead to early cardiovascular morbidity if not detected early. Lifestyle behaviors such as diet, physical activity, and body mass index (BMI) are strongly associated with adolescent blood pressure levels.
Methods: A cross-sectional study was conducted in March–April 2025 among 120 adolescents aged 15–18 years in senior high schools in Temanggung Regency, Central Java, Indonesia. Data were collected using structured questionnaires on lifestyle (diet, physical activity, smoking) and blood pressure measurement using a digital sphygmomanometer. Chi-square test was used to analyze associations between lifestyle factors and hypertension.
Results: The prevalence of hypertension among participants was 14.2%. Hypertension was significantly associated with overweight/obesity (p=0.001), low physical activity (p=0.012), and high-salt diet (p=0.021). No significant association was found with smoking (p=0.165).
Conclusion: Lifestyle factors such as BMI, a high physical activity, and low high salat diet are strongly associated with hypertension among adolescents. Preventive interventions through school-based education and routine screening are essential to reduce long-term cardiovascular risks, long term impact of hypertension leading to chronic kidney dsease and cardiovascular disease

Keyword : Adolescent health, hypertension, lifestyle

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Background. Hypertension is recognized as one of the leading risk factors for cardiovascular disease and premature mortality worldwide. According to the World Health Organization (2020), an estimated 1.13 billion people globally live with hypertension, with a large proportion remaining undiagnosed. Traditionally, hypertension has been viewed as a health problem affecting adults; however, increasing evidence shows that hypertension can develop as early as adolescence and often persists into adulthood, significantly increasing the risk of long-term cardiovascular complications (Yang et al., 2021). Adolescence is a critical period of growth and development marked by rapid physical, psychological, and social changes. During this period, health behaviors such as diet, physical activity, and lifestyle patterns are established and often carried into adulthood (Lo et al., 2020). Unfortunately, modern lifestyle trends, including high consumption of processed foods rich in salt and fat, sedentary behavior due to digital screen time, and inadequate sleep, have negatively influenced adolescent health worldwide (Miller et al., 2021). These behavioral changes have been strongly linked to the early onset of hypertension and other metabolic disorders (Sanyaolu et al., 2019).

In Indonesia, the 2018 *Riset Kesehatan Dasar* (Riskesdas) reported a rising prevalence of hypertension across all age groups, including adolescents (Kemenkes RI, 2018). In Central Java, particularly in Temanggung Regency, adolescent health faces unique challenges. Dietary habits often include high-salt traditional foods, while physical activity levels have declined due to the widespread use

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of gadgets and limited engagement in outdoor activities. These local conditions may contribute to the emergence of hypertension at an earlier age, yet hypertension in adolescents often remains underdiagnosed due to limited awareness and lack of routine blood pressure screening in schools (Patel & Walker, 2022).

The selection of Temanggung Regency as the research location was based on several considerations. First, although hypertension prevalence in Central Java is relatively high, local data focusing on adolescents are still scarce. Conducting this study in Temanggung helps address this knowledge gap and provides evidence for local health planning. Second, Temanggung has unique socio-cultural characteristics, particularly in dietary patterns, as traditional foods consumed daily often contain high levels of salt. This cultural habit potentially influences adolescent blood pressure levels. Third, adolescents in Temanggung are increasingly adopting sedentary lifestyles due to prolonged gadget use and declining outdoor activity, a trend that mirrors global concerns but needs local evidence. Fourth, the local government is currently strengthening programs to reduce non-communicable diseases. Findings from this study are expected to directly support school-based health programs and adolescent health services in Temanggung.

Previous studies have consistently shown that overweight/obesity, poor dietary intake, and low physical activity are significant predictors of hypertension in adolescents (Dong et al., 2022; Spruill, 2020; Martiningsih et al., 2024). However, research focusing specifically on Indonesian adolescents, especially in smaller regions such as Temanggung, is still limited. This gap highlights the need for local data to inform context-appropriate preventive strategies.

Given the potential long-term burden of adolescent hypertension, early detection and preventive interventions are crucial. Nurses and midwives, as front-line health professionals in community and school health programs, play a strategic role in health promotion, lifestyle education, and routine screening.

Therefore, this study aims to analyze the relationship between lifestyle factors (diet, physical activity, smoking, and body mass index) and hypertension among adolescents in Temanggung Regency, Central Java. Findings from this study are expected to contribute to evidence-based recommendations for preventive programs that can be integrated into school health initiatives and community nursing practices

Methods. This research employed a cross-sectional design and was carried out from March to April 2025 in several senior high schools in Temanggung Regency, Central Java. The study population consisted of 350 students aged 15–18 years enrolled in grades 10–12. A simple random sampling technique was applied to select participants, ensuring that every eligible adolescent in the population had an equal chance of being included. The sampling frame was obtained from the school administration, which provided a complete list of students. Using this list, random numbers were generated with the help of a computer-based randomization tool to identify the study sample. From the 350 students in the population, 120 adolescents were selected.

The inclusion criteria were Adolescents aged 15–18 years enrolled in the selected schools, Physically present at the time of data collection, Willing to participate voluntarily and provide informed consent, with parental/guardian approval for those under 18 years. Students with known congenital heart disease, chronic kidney disease, or on antihypertensive medication were excluded to avoid confounding factors.

Lifestyle factors such as diet, physical activity, and smoking habits were measured using a structured questionnaire developed based on WHO adolescent health guidelines. Dietary patterns were assessed by the frequency of high-salt and high-fat food consumption, physical activity was categorized according to WHO recommendations, and smoking status was self-reported.

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Anthropometric and physiological measurements were also conducted. Body weight and height were measured to calculate Body Mass Index (BMI), which was then classified according to WHO adolescent growth standards.

Blood pressure was measured using a calibrated digital sphygmomanometer, with each participant measured twice in a seated position after resting for at least five minutes. Hypertension was defined as systolic and/or diastolic blood pressure equal to or greater than the 95th percentile for age, sex, and height (American Academy of Pediatrics, 2017).

Data were analyzed using descriptive statistics and Chi-square tests to examine the association between lifestyle factors and hypertension. A p-value <0.05 was considered statistically significant. Ethical clearance was obtained from the Health Polytechnic Ethics Committee, and informed consent was secured from both participants and their parents or guardians.

Result and Discussion.

Characteristics of Respondents

A total of 120 adolescents participated in this study, with 66 females (55%) and 54 males (45%). The mean age of participants was 16.2 years, reflecting the mid-adolescent period where rapid physical and psychosocial development occurs. The distribution of nutritional status showed that 22.5% of respondents were overweight or obese. This proportion is slightly higher than the national prevalence reported in Riskesdas (2018), which found overweight and obesity rates among adolescents at 20.0%. The prevalence of low physical activity in this study was 35%, while 40% of adolescents reported frequent consumption of high-salt diets.

Table 1 Characteristics of Respondents

Characteristics	n	%
Gender (Male)	54	45.0
Gender (Female)	66	55.0
Mean Age (years)	16.2	-
Overweight/Obese	27	22.5
Low Physical Activity	42	35.0
High-Salt Diet	48	40.0

Prevalence of Hypertension

The overall prevalence of hypertension among respondents was 14.2% (17 adolescents). This figure is consistent with findings from Dong et al. (2022) who reported a global prevalence of 4–12% in adolescents, with higher figures observed in urbanized and low-to-middle-income settings. The slightly elevated prevalence in Temanggung may reflect local dietary habits characterized by high-salt traditional foods and decreasing levels of physical activity due to digital screen time.

Associations Between Lifestyle Factors and Hypertension

Statistical analysis revealed significant associations between several lifestyle factors and hypertension.

Table 2. Association between Lifestyle Factors and Hypertension

Lifestyle Factors	Hypertension (%)	No Hypertension (%)	p-value
Over weight Obese	40.7	15.3	0.001
Low Physical Activity	28.6	11.5	0.012
High-Salt Diet	30.0	12.0	0.021
Smoking	10.5	13.8	0.165

Adolescents who were overweight or obese had a markedly higher prevalence of hypertension (40.7%) compared to those with normal BMI (15.3%), with a significant p-value of 0.001. This finding reinforces the strong link between excess body weight and elevated blood pressure, which has been consistently documented in previous studies (Sanyaolu et al., 2019; Yang et al., 2021).

Low physical activity was also significantly associated with hypertension (p=0.012). Adolescents with low activity levels showed a 28.6% prevalence of hypertension, nearly three

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times higher than their active peers (11.5%). Similar results were reported by Patel & Walker (2022), who emphasized that reduced physical activity contributes to early vascular changes and increased cardiovascular risk in adolescents.

Dietary factors also played a role. Adolescents reporting frequent consumption of high-salt foods had a higher prevalence of hypertension (30.0%) compared to those with lower intake (12.0%), with a significant association (p=0.021). This aligns with WHO guidelines (2020) highlighting salt reduction as a global priority for hypertension prevention.

Interestingly, smoking did not show a significant association with hypertension (p=0.165). This may be explained by the relatively low prevalence of smoking in the sample, especially among females. However, it is important to note that smoking has long-term cardiovascular impacts, and the absence of a significant association in this study should not undermine its recognized health risks.

The results of this study underscore the critical role of modifiable lifestyle factors in shaping hypertension risk among adolescents. The strong association between overweight/obesity and hypertension reflects the growing problem of adolescent obesity in Indonesia, which parallels global trends (Lo et al., 2020). The finding is particularly concerning because overweight adolescents are more likely to remain obese into adulthood, perpetuating cardiovascular risks (Miller et al., 2021).

Physical inactivity emerged as another significant determinant of hypertension. With 35% of adolescents reporting low activity, this study supports global concerns about sedentary behavior among youth. In Temanggung, the increasing use of digital devices and reduced engagement in traditional outdoor activities may contribute to this trend. Intervention strategies must therefore not only promote physical activity but also adapt to current adolescent lifestyles, for instance by encouraging structured school-based sports or community youth programs.

The association between high-salt diet and hypertension in this study reflects both global evidence and local cultural patterns. In many Javanese households, traditional meals are often preserved or seasoned with high salt content. This cultural habit, if not balanced with health education, could predispose adolescents to higher blood pressure early in life. School-based nutrition education programs and family counseling led by nurses and midwives could be effective strategies to address this challenge.

The lack of association between smoking and hypertension in this study contrasts with evidence from adult populations where smoking is a well-established risk factor (Spruill, 2020). This discrepancy may be due to the lower frequency and shorter duration of smoking among adolescents in the study sample. However, given that smoking often begins during adolescence and tracks into adulthood, preventive strategies targeting smoking initiation remain essential.

From a public health perspective, these findings highlight the need for early, school-based screening and interventions targeting lifestyle modification. Nurses and midwives are strategically positioned to play a central role in these interventions. Their involvement in adolescent health programs—through routine blood pressure measurement, health education sessions, and counseling for families—could substantially reduce the long-term burden of hypertension.

LIMITATIONS OF THE STUDY

This study has several limitations. First, the cross-sectional design limits the ability to establish causal relationships between lifestyle factors and hypertension; the associations observed can only suggest correlations, not directionality. Second, the data on lifestyle behaviors such as diet, physical activity, and smoking were self-reported, which may introduce recall bias or social desirability bias. Third, the study was conducted in selected senior high schools in Temanggung Regency, which may limit the generalizability of the

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findings to adolescents in other regions or out-of-school youth. Finally, blood pressure was measured at a single point in time; repeated measurements over several days would have provided more robust diagnostic accuracy.

Despite these limitations, the study provides valuable local evidence on adolescent hypertension and highlights the importance of lifestyle-related factors in early prevention efforts

Conclusion and Suggestions. This study provides the first local evidence on the prevalence and risk factors of adolescent hypertension in Temanggung Regency, Central Java. The findings highlight the urgent need to address hypertension prevention in adolescents, as 14.2% of participants were identified with elevated blood pressure. Overweight/obesity, low physical activity, and high-salt diet were significantly associated with hypertension, while smoking showed no significant relationship

Practical Implications. Interventions should be directed at school and family levels. Specifically, integration of routine blood pressure screening into school health services (*UKS/M*), development of school-based nutrition modules tailored to adolescents, and family-based “reduce salt” campaigns can serve as effective preventive measures. Nurses and midwives, as front-line health workers, play a central role in implementing these activities through health education, counseling, and early detection programs.

Policy Recommendations. At the district level, the Temanggung Health Office should strengthen adolescent health programs with a focus on non-communicable disease prevention. At the provincial and national levels, these findings support the inclusion of adolescent hypertension screening and lifestyle interventions in broader strategies for controlling cardiovascular risk factors. Policies should ensure adequate resources, training for school health personnel, and monitoring systems to track adolescent hypertension trends.

Future Research. Further longitudinal studies are recommended to monitor the progression of adolescent hypertension into adulthood, as well as intervention trials to evaluate the effectiveness of school- and family-based health promotion strategies

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