Prevalence and Risk Factors of Hypertension in Adolescents

Andi Alifah Aulya Sultan[1], Andi Zulkifli[2], Ridwan Amiruddin[2], Healthy Hidayanty[3], Suriah[4]

Abstract

Background: Hypertension is increasingly recognized as a significant health concern in adolescents globally, including in Indonesia. Early detection and management are essential for preventing long-term cardiovascular diseases. However, the prevalence, risk factors, and effective intervention strategies for hypertension in Indonesian adolescents remain underexplored. Methods: This study assessed hypertension prevalence and identified contributing factors among adolescents in Indonesia. A cross-sectional study design was used, involving 1,000 adolescents aged 12–18 years from multiple regions in Indonesia. Blood pressure measurements were taken following standardized protocols, and socio-demographic, lifestyle, and family medical history data were collected through structured questionnaires. Data were analyzed using descriptive and inferential statistics to evaluate associations between hypertension and various risk factors. Results: The study found a hypertension prevalence of 13.2% among the adolescent participants. Key risk factors included a high body mass index (BMI), sedentary lifestyle, unhealthy dietary habits, and a family history of hypertension. Additionally, adolescents with low levels of physical activity and poor dietary habits were significantly more likely to develop hypertension. Conclusion: Hypertension is a growing health problem in Indonesian adolescents, with modifiable risk factors such as diet and physical activity playing significant roles. Public health interventions focusing on lifestyle modifications, early screening, and education about hypertension prevention are crucial for reducing future cardiovascular risks in this demographic. Further studies are recommended to explore long-term trends and intervention effectiveness.

Keywords: Hypertension, Adolescents, Indonesia, Prevalence, Risk Factors

Significance | This study determines hypertension prevalence and associated risk factors in Indonesian adolescents, crucial for targeted public health interventions.

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1. Introduction

Non-communicable diseases (NCDs) have emerged as a significant public health concern in Indonesia, with their prevalence steadily increasing and exerting profound effects on public health systems and communities (Mahipala, Dorji, Tisocki, & Rani, 2019; Nugraheni & Hartono, 2018). NCDs, also referred to as chronic diseases, are characterized by their non-transmissible nature, stemming from a complex interplay of genetic, physiological, environmental, and behavioral factors (Purnamasari, 2018). Commonly associated with unhealthy lifestyles—such as smoking, high-fat diets, and physical inactivity—NCDs contribute to the global burden of disease by exacerbating conditions such as high cholesterol, obesity, and hypertension (Nugraheni & Hartono, 2018).

Hypertension, a critical NCD, exemplifies the growing health challenge. While often perceived as a condition predominantly affecting adults, hypertension is increasingly diagnosed among

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adolescents. Globally, the prevalence of adolescent hypertension ranges between 4% and 15%, yet only 26% of cases are accurately diagnosed (Fitrianah et al., 2023). Data from the National Health and Nutrition Examination Survey (NHANES) revealed that one in ten children aged 8–17 years experience prehypertension or hypertension (Untari, Etnis, & Permata, 2022). Similarly, recent statistics from the Centers for Disease Control and Prevention (CDC) indicate that 1 in 25 adolescents aged 12–19 years is hypertensive, with 1 in 10 cases having progressed from prehypertension . Research conducted in various countries underscores the alarming prevalence of this condition. For example, studies in India and China found hypertension rates among adolescents exceeding 20% (Vasudevan, Thomas, Kurpad, & Sachdev, 2022; Zhou et al., 2022).

The rising prevalence of hypertension among adolescents is particularly concerning due to its long-term implications. Adolescents with elevated blood pressure are at a heightened risk of developing essential hypertension in adulthood, thereby increasing their vulnerability to cardiovascular and other chronic diseases (Wahyudi & Albary, 2021). Adolescence, a critical period for establishing health behaviors, is often marked by insufficient knowledge about hypertension and its associated risks. Research highlights that limited awareness among adolescents significantly influences unhealthy behaviors, including poor dietary habits, insufficient physical activity, and inadequate blood pressure monitoring (Sabillah & Aidha, 2023; Rahmah & Kurniasari, 2024).

In Indonesia, various studies emphasize the need for early intervention to address this issue. For instance, research by Siswanto and Afandi (2019) showed that many Indonesian adolescents lack awareness regarding the importance of regular blood pressure monitoring and the dangers posed by hypertension. Moreover, the study by Wiguna et al. (2024) advocates for early prevention efforts targeting adolescents to curb the increasing number of hypertension cases. This calls for educational strategies that promote knowledge, awareness, and behavioral changes among young individuals.

Health promotion initiatives spearheaded by the Ministry of Health have employed diverse methods, including communication, information dissemination, and education campaigns. These efforts aim to enhance the public's knowledge, motivation, and proactive behavior in preventing and managing hypertension (Primadevi et al., 2024). Health communication plays a pivotal role in these initiatives by disseminating critical information about disease prevention and encouraging individuals to adopt healthier lifestyles (Widyaningrum et al., 2024). Effective health communication fosters awareness not only at the individual level but also within families and communities, creating a ripple effect that promotes collective health improvements.

Epidemiological data provide valuable insights into the local prevalence and dynamics of hypertension. In Bone Regency, Indonesia, two distinct sub-districts, Kahu and Patimpeng, exemplify the disparities in hypertension prevalence and healthcare access. At SMAN 6 Bone in Kahu, the hypertension prevalence reached 23.8%, with 9,712 reported cases in 2021. Of these, women accounted for 57.6% of cases (Dinas Kesehatan Kabupaten Bone, 2022). Despite these high numbers, only 56.9% of hypertensive individuals accessed health services, highlighting the need for targeted interventions. Meanwhile, at SMAN 19 Bone in Patimpeng, the prevalence was lower at 20%, with women comprising 57% of cases. Health service access was relatively better at 66.3%, yet preventive measures remain insufficient (Dinas Kesehatan Kabupaten Bone, 2022).

These statistics underscore the importance of tailored prevention strategies for adolescents in both regions. Evidence suggests that interpersonal communication, characterized by its personalized and interactive approach, is an effective tool for enhancing health knowledge and promoting behavioral change (Sulaiman, 2008). Interpersonal communication has been shown to significantly influence adolescents' knowledge, attitudes, and practices regarding hypertension prevention (Verawati et al., 2020). By engaging directly with adolescents in settings such as schools, healthcare providers and educators can foster meaningful discussions, address misconceptions, and encourage proactive health behaviors (Tuturop et al,2024)

In light of the increasing prevalence of adolescent hypertension and its long-term consequences, this study explores the comparative effectiveness of interpersonal communication and counseling in promoting early hypertension prevention behaviors among students at SMAN 6 Bone and SMAN 19 Bone. The findings aim to inform the development of targeted interventions that address the unique needs and challenges of adolescents in these communities. By prioritizing preventive efforts and leveraging effective communication strategies, it is possible to mitigate the growing burden of hypertension and its associated health risks.

2. **Materials and Methods**

2.1 Study Design

This quasi-experimental study employed a pretest-posttest design with a control group (Figure 1). The sample consisted of 110 11th-grade students, divided equally into an experimental group (n=55) and a control group (n=55). The experimental group, comprising students from SMAN 6 Bone, received interpersonal communication interventions, while the control group, from SMAN 19 Bone, received counseling interventions.

The sampling method was probability sampling using a simple random sampling technique, ensuring each individual in the population had an equal opportunity to be selected. This method

aimed to achieve a representative sample, thereby enhancing the generalizability of the study findings. Sample selection was conducted through a random draw, minimizing selection bias.

2.2 Interventions

*2.2.1*Experimental Group

Participants in the experimental group received face-to-face interpersonal communication. Each session involved a direct, one-on-one approach between resource persons and respondents. The group of 55 participants was divided into five smaller groups, with a total of five facilitators, including the lead researcher and four supporting team members.

A specially designed module containing critical information on hypertension served as the primary media for the intervention. The session commenced with a pretest lasting five minutes, followed by the intervention lasting 10–15 minutes. This single-session intervention was conducted in person. A posttest was administered one month later to evaluate changes in participants' knowledge, attitudes, and actions.

2.2.2. Control Group

Participants in the control group received a structured counseling session. The session utilized multimedia aids, including an LCD projector and laptop, to deliver the content. The counseling material followed a standardized framework provided by the Extension Program Unit. Each session lasted 30 minutes and included the same information provided to the experimental group.

2.3 Instruments

The study employed a structured questionnaire to measure intervention effectiveness, focusing on knowledge, attitudes, and actions related to hypertension prevention. The questionnaire included demographic questions (age and gender) and a series of questions assessing hypertension prevention behavior.

2.4 Data Collection

Data collection involved both primary and secondary data sources. Secondary data on hypertension incidence and student enrollment for the 2024/2025 academic year were obtained from the Bone Regency Health Office and the Student Affairs Section of SMAN 6 Bone and SMAN 19 Bone, respectively. Primary data were collected through pretest and posttest questionnaires distributed to participants in both groups.

2.5 Statistical Analysis

Data analysis included univariate analysis to describe the frequency distribution of respondent characteristics. Bivariate analysis using independent t-tests and Mann-Whitney tests compared mean differences between the experimental and control groups after the interventions. Statistical significance was set at $p < 0.05$.

2.6 Ethical Considerations

Ethical approval for the study was obtained from the relevant Institutional Review Board. Written informed consent was secured from all participants and their guardians prior to participation. Confidentiality of the participants' data was maintained throughout the study, and participation was entirely voluntary, with the option to withdraw at any time without consequences. This study has received ethical approval from the Health Research Ethics Committee (KEPK) of the Faculty of Public Health, Hasanuddin University, with approval number 2946/UN4.14.1/TP.01.02/2024 dated October 8, 2024.

3. **Results**

3.1 Univariate Analysis

RespondentCharacteristics

The demographic characteristics of the respondents are summarized in Table 1. Most participants in the study were aged 15–16 years. Within the experimental group, 47.62% of respondents fell into this age range, while the control group had a slightly higher proportion at 52.38%. Regarding gender distribution, the experimental group was predominantly female, with 67.27% of respondents being female. In contrast, the control group exhibited a more balanced gender distribution, with 49.09% male and 50.91% female respondents.

3.2 Characteristics of Research VariablesKnowledge Scores

The changes in knowledge scores for both groups are detailed in Table 2. In the experimental group, the pretest results revealed that 5.45% of respondents scored in the low category, 32.73% in the moderate category, and 61.82% in the high category. Following the intervention, the posttest results showed a marked improvement, with 87.27% of respondents scoring in the high category, 12.73% in the moderate category, and none remaining in the low category.

For the control group, the pretest results indicated that 1.82% of respondents scored in the low category, 45.45% in the moderate category, and 52.73% in the high category. The posttest results demonstrated minor improvements, with 5.45% in the low category, 25.45% in the moderate category, and 69.09% in the high category.

3.3AttitudeScores

Table 3 highlights the changes in attitude scores for both groups. In the experimental group, pretest results showed that 1.82% of respondents scored in the low category, 41.82% in the moderate category, and 56.36% in the high category. Posttest results indicated significant changes, with 85.45% of respondents scoring in the high category, 14.55% in the moderate category, and none in the low category.

In the control group, pretest results revealed that 1.82% of respondents were in the low category, 56.36% in the moderate category, and 41.82% in the high category. Posttest results showed slight variations, with 3.64% in the low category, 49.09% in the moderate category, and 47.27% in the high category.

3.4ActionScores

Changes in action scores are summarized in Table 4. In the

experimental group, pretest results indicated that 50.91% of respondents were in the low category, 32.73% in the moderate category, and 16.36% in the high category. After the intervention, posttest results showed notable improvements, with 45.45% of respondents scoring in the high category, 41.82% in the moderate category, and 12.73% in the low category.

In the control group, pretest results revealed that 52.73% of respondents were in the low category, 34.55% in the moderate category, and 12.73% in the high category. Posttest results demonstrated slight changes, with 54.55% remaining in the low category, 18.18% in the moderate category, and 27.27% in the high category.

3.5 Bivariate Analysis

The effectiveness of the intervention was analyzed using the Mann-Whitney test, as shown in Table 5. In the experimental group, significant improvements were observed across all variables. The mean knowledge score increased from 75.45 to 90.73, while the mean attitude score rose from 75.09 to 83.65. Additionally, the mean action score improved from 56.18 to 73.45.

In the control group, the mean knowledge score showed a marginal increase from 78.73 to 79.45. Attitude scores experienced a slight decrease, dropping from 74.00 to 73.75. The mean action score in the control group increased modestly from 54.90 to 58.73.

Statistical analysis using the Mann-Whitney test revealed significant differences between the experimental and control groups in all three variables:

- Knowledge: p=0.017p = 0.017p=0.017
- Attitude: p=0.000p = 0.000p=0.000
- Action: p=0.002p = 0.002p=0.002

Summary

The findings demonstrate that interpersonal communication was significantly more effective than counseling in improving knowledge, attitudes, and actions related to hypertension prevention among adolescents. While the control group exhibited minor improvements in knowledge and actions, their attitude scores showed a slight decline. These results underscore the potential of personalized interpersonal communication as an effective strategy for promoting positive behavioral changes.

4. **Discussion**

4.1 Knowledge

Knowledge results from human sensory processes involving the five senses: sight, hearing, smell, taste, and touch. It is shaped by attention intensity and perception derived from personal experiences, which continuously evolve through environmental interactions. Each individual's unique knowledge reflects their perception and understanding of the surrounding world, illustrating that knowledge undergoes constant development and reorganization throughout life (Arimurti & Nurmala, 2017; Dewi & Sudaryanto, 2020; Nursyamsi et al, 2020).

The statistical test results for pretest-posttest knowledge scores between the experimental and control groups demonstrated significant outcomes ($p = 0.017$, $p < 0.05$), indicating a meaningful difference in knowledge scores before and after the intervention. This finding highlights that interpersonal communication effectively enhances knowledge in the experimental group compared to the control group.

Research by Sulaiman (2008) supports these findings, indicating that interpersonal communication significantly enhances knowledge among female adolescents at SMAN Muhammadiyah 2 Palembang. The Wilcoxon test revealed a significant p-value of 0.000 ($p < 0.05$). Knowledge is primarily acquired through sight and hearing, making visual and auditory activities in interpersonal communication particularly effective in fostering understanding. This is further supported by Barus and Rajagukguk (2023), who found a significant relationship ($p = 0.031$, $p < 0.05$) between healthcare workers' interpersonal communication and patients' knowledge at Puskesmas PB Selayang 2 Medan.

To improve the quality of interpersonal communication, healthcare workers should emphasize openness, honesty, empathy, supportiveness, and equality in their interactions. Devito (2007) explains that interpersonal communication serves diverse purposes, including self-awareness, learning about the world, building relationships, influencing attitudes and behaviors, and providing assistance. These objectives align with the observed effectiveness of interpersonal communication in enhancing knowledge.

4.2 Attitude

Attitude encompasses an individual's evaluation—comprising feelings, beliefs, and behaviors—toward specific stimuli or objects, which can manifest as positive or negative responses.

It reflects the capacity to communicate thoughts, feelings, and confidence through words, gestures, or actions (Candra et al., 2017; Sukarelawati, 2019).

The statistical test results for pretest-posttest attitude scores between the experimental and control groups revealed a significant difference ($p = 0.000$, $p < 0.05$). This indicates that the interpersonal communication method is more effective in changing attitudes in the experimental group than in the control group. Verawati et al. (2020) found similar results in Mamuju Regency, where interpersonal communication influenced adolescent attitudes toward early marriage prevention, with a significant contribution of 76.4% ($p = 0.001$, $p < 0.05$).

The Stimulus-Organism-Response (S-O-R) Theory provides a theoretical framework for understanding these findings. According to this theory, the communicator's credibility and capability significantly determine behavior change in the receiver (Notoatmodjo, 2014). The stimulus—the message delivered—is

processed by the organism (receiver), resulting in a response, such as improved knowledge and attitudes regarding health issues. These findings align with Sulaiman (2008), who demonstrated a significant impact of interpersonal communication on adolescent attitudes ($p = 0.000$, $p < 0.05$).

A positive attitude is characterized by behaviors aligned with expectations, such as acceptance, friendliness, initiative, and goal-oriented actions. Conversely, a negative attitude manifests through unclear behavior, opposition, doubt, apathy, or hostility. Data suggest that interpersonal communication fosters positive attitude changes by enabling individuals to accept conveyed information effectively. These findings underscore the method's effectiveness in shaping attitudes as intended.

Choirunissa and Ediati (2018) highlighted a significant positive correlation (correlation value = 0.555, $p < 0.001$) between adolescents' interpersonal communication with parents and emotional regulation among students at SMKN 5 Semarang. Effective communication between parents and adolescents fosters warm, respectful interactions, enhancing emotional regulation. By engaging in continuous communication—from casual conversations to serious discussions—parents provide full attention and create a supportive environment for adolescents. This open communication strengthens relationships and fosters mutual understanding.

In conclusion, the statistical and empirical evidence demonstrates the pivotal role of interpersonal communication in improving knowledge and shaping attitudes. By prioritizing effective communication practices—characterized by openness, empathy, and support—healthcare workers, educators, and parents can significantly enhance knowledge and foster positive attitudes in their respective contexts.

4.3 Action and Its Influence on Behavior

Action is a fundamental component that shapes an individual's engagement in activities. It often manifests as social actions, which reflect behavior and orientation towards others. These actions encompass directly observable activities and more complex attitudes, translating into tangible acts that can be observed (Gani et al., 2022).

A statistical test on pretest and posttest action scores revealed significant differences between the experimental and control groups ($p = 0.002$, $p < 0.05$). This indicates that interpersonal communication methods were more effective in altering actions within the experimental group compared to the control group. These results highlight the potential of interpersonal communication as a powerful tool in modifying behavior.

A study by Fitriadi (2022) supports this conclusion, demonstrating a significant relationship between interpersonal communication by healthcare workers and hypertension prevention actions among patients at the Puskesmas Gadang Hanyar Banjarmasin ($p = 0.000$). The study found that effective interpersonal communication contributed 95.9% to the successful implementation of preventive measures among hypertension patients. This finding underscores the importance of clear and effective communication in healthcare settings.

Respondents who understood the information provided by healthcare workers were more likely to follow recommended actions, such as regular blood pressure checks (Fitriadi, 2022). Effective communication ensured that patients grasped the importance of preventing blood pressure elevation, leading to better adherence to preventive measures.

Research by Wijayanti (2019) corroborates these findings, indicating that interpersonal communication positively influences adolescent behavior ($R = 0.881$, $F = 106.779$, $p < 0.01$). The study showed that interpersonal communication contributed 65.8% to shaping adolescent behavior. By fostering understanding and mutual respect, interpersonal communication serves as a vital tool for influencing attitudes and actions.

Effective interpersonal communication involves five key indicators: understanding, pleasure, attitude influence, relationship quality improvement, and action. When communicators carefully choose their words, prepare thoroughly, and deliver messages effectively, communication becomes more impactful (Wijayanti, 2019).

4.4 Differences in Knowledge, Attitudes, and Actions

The comparison of knowledge, attitude, and action scores between experimental and control groups underscores the greater impact of interpersonal communication in promoting hypertension prevention behaviors compared to traditional counseling methods. During adolescence, interpersonal communication skills play a pivotal role in identity formation and social relationships. These skills are particularly effective in influencing adolescent behavior due to their emphasis on empathy, problem-solving, and adaptability (Rakhmaniar, 2024).

According to interpersonal communication theory, messages conveyed by communicators elicit feedback, which can be positive, negative, or neutral. The effectiveness of this feedback largely depends on the communicator's ability to present the message in an engaging manner (Monika et al., 2023). Failure in interpersonal communication occurs when individuals avoid interactions, leading to ineffective message delivery (Chairunnisa et al., 2024).

The quality of interpersonal communication is influenced by openness, empathy, support, and equality. These elements create a supportive relationship between communicators and communicants, ensuring that communication patterns are optimal and messages are received positively. Open communication, which involves sharing information and expressing emotions responsibly, fosters meaningful interactions and facilitates message delivery (Arhani et al., 2024).

Table 1. Frequency Distribution of General Characteristics of Respondents at SMAN 6 Bone and SMAN 19 Bone Year 2024

General Characteristics of Respondents	Experimental		Control	
	n	%	n	%
Age (year)				
15 – 16	40	47,62	44	52,38
17 - 19	15	57,69	11	42,31
Gender				
Male	18	32,73	27	49,09
Female	37	67,27	28	50,91
Total	55	100	55	100

Table 2. Frequency Distribution of Respondents Knowledge Before and After Intervention Among Students at SMAN 6 Bone and SMAN 19 Bone in 2024

Knowledge	Experimental				Control			
	Pretest		Posttest		Pretest		Posttest	
	n	%	n	%	n	%	n	%
Good	34	61,82	48	87,27	29	52,73	38	69,09
Adequate	18	32,73	7	12,73	25	45,45	14	25,45
Poor	3	5,45	0	0,00	1	1,82	3	5,45
Total	55	100	55	100	55	100	55	100

Table 3. Frequency Distribution of Respondents Attitude Before and After Intervention Among Students at SMAN 6 Bone and SMAN 19 Bone in 2024

Attitude	Experimental				Control			
	Pretest		Posttest		Pretest		Posttest	
	n	%	n	%	n	%	n	%
Good	31	56,36	47	85,45	23	41,82	26	47,27
Adequate	23	41,82	8	14,55	31	56,36	27	49,09
Poor	1	1,82	0	0,00	1	1,82	2	3,64
Total	55	100	55	100	55	100	55	100

Table 4. Frequency Distribution of Respondents Action Before and After Intervention Among Students at SMAN 6 Bone and SMAN 19 Bone in 2024

Action	Experimental				Control			
	Pretest		Posttest		Pretest		Posttest	
	n	%	n	%	n	%	n	%
Good	9	16,36	25	45,45	7	12,73	15	27,27
Adequate	18	32,73	23	41,82	19	34,55	10	18,18
Poor	28	50,91	7	12,73	29	52,73	30	54,55
Total	55	100	55	100	55	100	55	100

Table 5. Characteristics of Mean Values of Knowledge, Attitude, and Action in the Experimental and Control Groups

Variables	**Experimental Group**		**Control Group**		**p-value**
	Pretest	**Posttest**	**Pretest**	**Posttest**	
Knowledge	75.45 ± 10.86	90.73 ± 10.52	78.73 ± 14.15	79.45 ± 12,24	0.017*
Attitude	75.09 ± 7.85	83.65 ± 6.18	74 ± 8.27	73.75 ± 9.17	0.000*
Action	56.18 ± 17.16	73.45 ± 16.69	54.90 ± 17.52	58.73 ± 20.73	0.002*

Notes: Values are in mean ± standard deviation.

Knowledge, attitude, and practice= mann-whitney test.

*p < 0.05 (within-group analysis).

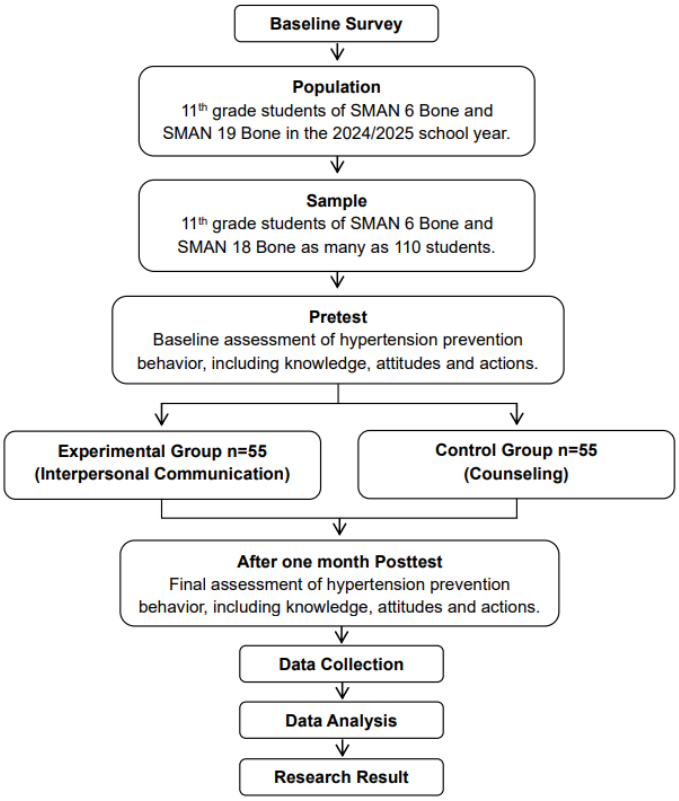

Figure 1. Flow Chart of The Research

Figure 2. Research Documentation

Fikrina et al. (2023) explored the relationship between behavior and interpersonal communication between parents and children in Doro District, Pekalongan Regency. The study found a significant negative correlation between poor communication and negative behaviors. Conversely, effective communication reduced the prevalence of negative behaviors, highlighting the critical role of strong interpersonal communication in shaping positive outcomes. Interpersonal communication surpasses other forms of communication in changing attitudes, beliefs, opinions, and behaviors. The face-to-face nature of interpersonal communication enables direct personal contact, allowing communicators to receive immediate feedback and adapt their messages accordingly (Nurlita et al., 2024).

4.5 Adolescent Development and Behavior

Interpersonal communication skills are particularly crucial in adolescent development, significantly influencing behavior and preventing health issues. Effective communication, characterized by openness, empathy, and equality, supports positive behavioral changes. Given the critical role of interpersonal communication in shaping knowledge, attitudes, and actions, both the communicator and the communicant's responses are instrumental in ensuring effective interactions. Developing robust interpersonal communication skills is essential for building harmonious relationships and fostering optimal behavioral development in adolescents.

4.6 Limitations of the Study

This study was conducted in two specific schools, which limits its generalizability to the broader adolescent population. Additionally, the intervention took place during a single meeting and within a restricted timeframe, making it impossible to measure its long-term effects. Furthermore, external factors such as family support and social environment, which could significantly influence participants' knowledge, attitudes, and actions, were not taken into account.

The research findings indicate that the interpersonal communication approach used in the intervention was more effective than counseling in enhancing students' knowledge, attitudes, and behaviors related to hypertension prevention. In the experimental group that received the interpersonal communication intervention, there was a significant improvement across all three aspects. This approach not only increased students' knowledge about hypertension but also fostered positive attitude changes and improved preventive behaviors. These results highlight the value of personalized and interactive communication methods in promoting behavior change, making this approach an effective alternative for health education targeting hypertension prevention in adolescents.

For healthcare professionals, integrating interpersonal communication techniques into health education programs is strongly recommended. This approach enables more meaningful and personalized interactions, which can enhance participants' understanding and engagement, especially when addressing topics that require behavioral change, such as hypertension prevention. Training healthcare workers in advanced communication skills is crucial to ensure they can deliver information effectively and responsively.

For students, active participation in health education programs on hypertension prevention is encouraged, with a focus on applying the knowledge gained in their daily lives. Additionally, students should be motivated to share the information they learn with their families and peers, amplifying the program's positive impact and fostering a broader culture of awareness and prevention.

5. Conclusion

This study demonstrates that the interpersonal communication approach is more effective than traditional counseling in enhancing students' knowledge, attitudes, and actions related to hypertension prevention. The intervention led to significant improvements in all three areas, emphasizing the importance of personalized and interactive communication methods in health education. Healthcare workers are encouraged to adopt and refine interpersonal communication strategies to foster deeper understanding and engagement among participants. Students should actively participate in such programs, apply the acquired knowledge in daily life, and share it within their communities. This approach offers a promising alternative for promoting long-term behavioral change in hypertension prevention.

Author contributions

A.A.A.S. contributed to data collection and manuscript drafting. A.Z. and R.A. were responsible for study design and data analysis. H.H. contributed to methodology and manuscript revision. S. supervised the study and provided critical revisions. All authors reviewed and approved the final manuscript.

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Competing financial interests

The authors have no conflict of interest.

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