



## Physical Activity and Television Watching Duration in Relation to Blood Pressure of School-Aged Children

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### Abstract

Hypertension in children is a serious threat due to a sedentary modern lifestyle. Low physical activity and high screen time are strongly suspected to be risk factors for increased blood pressure. Objective: To analyze the relationship between physical activity levels and television viewing/lying down duration with blood pressure in school-aged children in Mluweh Village. Methods: This observational study involved 105 students (6-17 years old) selected by total sampling. Blood pressure was classified based on the 2017 AAP Clinical Practice Guideline standards. Physical activity and television viewing/lying down duration were measured using a modified GPAQ questionnaire. Data were analyzed using the Chi-Square test ( $\alpha = 0.05$ ). Results: The majority of respondents had light physical activity (64.7%) and high television viewing/lying down duration (94.3%). Statistical analysis showed no significant relationship between physical activity levels and blood pressure ( $p = 0.814$ ). However, a statistically significant relationship was found between television viewing/lying down duration and blood pressure ( $p = 0.027$ ). Conclusion: High television viewing/lying down time exceeding 2 hours per day is a strong predictor of increased blood pressure in children. Limiting screen time from an early age is necessary to minimize the risk of long-term cardiovascular disorders.

### Introduction

Analyzing physical activity levels and blood pressure in school-age children is an important topic given their crucial role in long-term health. Adequate physical activity not only supports optimal growth and development but also contributes to normal blood pressure (Kunimatsu et al., 2024). However, with modern lifestyles tending towards a more sedentary lifestyle, children are spending far more time using gadgets (Aravindakshan et al., 2024) and (Alawiyah et al., 2022) than spending time outdoors. A sedentary lifestyle leads to anxiety later in life due to decreased physical activity and negatively impacts children's cardiovascular health (Sania, 2023). There are concerns that this lifestyle could potentially lead not only to a lack of movement but also to become a risk factor for various health problems later in life (Sembiring et al., 2022). One such risk factor is hypertension.

Hypertension, once synonymous with adult disease, is now becoming a serious threat to children (Van Why & Pan, 2022). The rise in hypertension cases caused by modern lifestyles, coupled with the consumption of foods high in salt, saturated fat, and sugar, exacerbates this risk (Singh et al., 2022) and (Ulfa et al., 2024). Children's habit of spending more time in front of screens than engaging in physical activity is also a contributing factor to this problem. This

situation is very concerning, especially because hypertension in children often goes undetected early (Jippm, 2024), given that its symptoms are not always obvious. If not treated appropriately, childhood hypertension is feared to persist into adulthood and increase the risk of cardiovascular disease, stroke, (Tu et al., 2023) and other serious complications later in life.

According to (Hasanudin et al., 2022), hypertension is strongly influenced by many factors, one of which is physical activity. Based on research data (Sriwijayanti, 2013), statistical tests show that the more overweight a child is, the less physically active they are. Therefore, inactive children tend to be overweight, which can ultimately lead to increased blood pressure (Andriani et al., 2024) and (Kang et al., 2022). This condition indicates a reciprocal relationship between physical activity levels, nutritional status, and the risk of hypertension in children. Children with low physical activity tend to experience body fat accumulation, which can disrupt metabolic balance, leading to increased blood pressure (Fadilah & Sefrina, 2022). Furthermore, low physical activity also negatively impacts blood vessel function and overall heart health (Widya H., 2025; Thijssen et al., 2011; El Assar et al., 2022).

Given the complexity of factors influencing hypertension in children, comprehensive and sustainable preventative measures are needed (Marissangan, 2024). Interventions should not only increase physical activity but also limit screen time (Ahmed et al., 2022; Gupta et al., 2022; Calcaterra et al., 2022). The roles of parents, schools, and the community are crucial in fostering healthy lifestyle habits from an early age (Agus Mulyana et al., 2024). School-based intervention programs such as regular exercise, regular blood pressure monitoring, and regular health education can be effective strategies (M., Dr. Sahib Saleh, 2016) in reducing the risk of hypertension and creating an environment conducive to healthy child growth and development. This is expected to reduce the prevalence of hypertension in children and minimize the risk of long-term complications (Robinson et al., 2024; Marcus et al., 2022; Roztoczyńska et al., 2025).

Research on physical activity levels and blood pressure in school-aged children aged 6-17 in Indonesia is still difficult to find. However, data from reports in news articles from the Indonesian Ministry of Youth and Sports (Kemenpora) indicates that the physical fitness levels of Indonesian children remain low. While a minimum of 60 minutes of moderate-to-high-intensity physical activity per day is recommended for children aged 5-17 (WHO Guidelines on Physical Activity and Sedentary Behavior - PubMed, n.d.), participation in physical activity among Indonesian children and adolescents remains low, with only around 34% meeting this requirement. Supported by several other studies, the incidence of hypertension in children in Indonesia cannot be found. However, several studies have reported incidence rates in children in various locations. Several studies in various cities in Indonesia reported prevalence rates of childhood hypertension varying between 14.8% and 22.5% (Ngantung et al., 2022; Sudikno et al., 2023; Islam et al., 2025; Soegiarto et al., 2023). This low level of physical activity contributes to low levels of physical fitness and a possible increased risk of hypertension in children. These findings indicate the need for greater attention to increasing physical activity and preventing risk factors for hypertension from an early age. Several previous studies have examined the relationship between physical activity and blood pressure in children. For example, a meta-analysis by Kim et al. (2024) in the journal *Hypertension Research* found that increased physical activity significantly lowers blood pressure in children and adolescents. Another study by Lopez et al. (2021) published in the *Journal of the American Heart Association* also showed that children with moderate to intense levels of physical activity are less likely to develop prehypertension or hypertension. Based on the issues and research identified, most studies have focused on children's physical activity and the incidence of childhood hypertension. Therefore, the findings do not specifically describe the level of physical activity and blood pressure in school-age children (Kolanowski et al., 2022; Uddin et al., 2025; Popowczak et al., 2022). This reinforces the importance of further research,

especially in specific locations like Mluweh Village, to better understand the health dynamics of school-age children. The results of this study are expected to provide valid empirical data for developing appropriate intervention programs, such as education on the importance of physical activity or promoting a healthy lifestyle for school-age children in Indonesia.

## Methods

This research was conducted from July 16 to July 19, 2025, at MTs Mujahidin Mluweh and SD Negeri Mluweh 01. The sample size for this study was 105 students, consisting of 65 boys and 40 girls, aged 6-17. The following is a description of the sample characteristics in the demographic table:

### Characteristics of the Research Sample

The characteristics of the sample in this study were analyzed to obtain a general overview of the basic profile of the participants. This analysis included several demographic and personal variables deemed relevant to the research focus, such as age and gender.

Table 1. Subject Characteristics, Physical Activity Level, and Duration of Television Viewing/Lying Down (n = 105)

Characteristics	Category	Frequency (n)	Percentage (%)
Gender	Male	65	61,91
	Female	40	38,09
Age Group	< 13 Years	36	34,29
	> 13 Years	69	65,71
Physical Activity Level	Mild	68	64,76
	Moderate (Active)	18	17,14
	Heavy (Active)	19	18,10
Duration of Watching Television/Lying Down (TV)	Low ( $\leq$ 2 Hours/Day)	6	5,71
	High ( $>$ 2 Hours/Day)	99	94,29

Based on the table above, all samples in this study were between 6 and 17 years of age, which meets the criteria for school-age children. In terms of gender, the sample proportion was unequal, with 61.91% males and 38.09% females. This distribution indicates that the data collected had uneven gender representation, allowing for a more objective analysis of physical activity levels and blood pressure in school-age children.

Blood pressure (BP) was measured using an Omron HEM-8712 digital sphygmomanometer equipped with cuffs specifically designed for children and adults to increase measurement stability and accuracy. Data collection was conducted on the same day, and during the study there were no additional subjects or academic activities outside the school schedule. Therefore, subjects were in a relatively normal learning environment and did not experience additional academic stress that could potentially affect the measurement results. Each subject underwent two blood pressure measurements in a sitting position, and the average value of the two measurements was used as the final result for classification purposes.

Classification of blood pressure status was performed individually referring to the AAP Clinical Practice Guideline 2017 (Flynn et al., 2017). In subjects aged <13 years, blood pressure classification was performed dynamically based on height percentiles obtained from converting Height-for-Age (H/U) Z-score values according to the 2007 World Health

Organization standards (Height-for-Age (5-19 Years), n.d.), with the help of the MSD Manuals clinical calculator (Calculator: Blood Pressure Percentiles, 0 to 17 Years (2017 Standards) - MSD Manual Professional Edition, n.d.). If the Z-score value was outside the interpolation range ( $\pm 3.09$ ), the nearest extreme limit value (P0.1 or P99.9) was used to obtain the appropriate blood pressure threshold. Blood pressure exceeding the P95 limit + 12 mmHg was classified as stage 2 hypertension. In subjects aged  $\geq 13$  years, blood pressure classification was performed using the absolute thresholds set by the AAP. For all age groups, the final blood pressure category was determined based on the highest clinical risk level achieved by systolic or diastolic blood pressure. Subject growth status was determined based on the WHO Growth Reference 2007 (Height According to Age (5-19 Years), n.d.) using the H/U indicator in the form of a Z-score value.

Physical activity was measured using the Global Physical Activity Questionnaire (GPAQ), adapted into Indonesian and modified for children and adolescents. To improve reporting accuracy, subjects were asked to specifically identify their hobbies and sports before completing the questionnaire. Subjects aged  $< 13$  years were interviewed directly by researchers using a simplified version of the GPAQ, while subjects aged  $\geq 13$  years completed the translated GPAQ questionnaire independently. GPAQ items converted into physical activity load included P1 (heavy-duty work), P4 (brisk walking), P7 (leisurely walking), P10 (high-intensity sports/extracurricular activities), and P13 (cycling), while item P16 (watching television/lying down) was recorded as activities not included in the activity load calculation.

Physical activity load was calculated using the metabolic equivalent of task (MET) approach by referring to activity-specific METy (Youth MET) values obtained from Smoothed METy data from the 2017 NCCOR Youth Compendium of Physical Activities (Butte et al., 2018). METy values were adjusted based on the subject's age group (6–9 years, 10–12 years, 13–15 years, and 16–18 years) and the type of activity performed. Total weekly activity load was calculated in MET-minutes/week using the formula: METy value  $\times$  activity duration (minutes/day)  $\times$  frequency (days/week). Furthermore, physical activity load was classified based on the moderate-to-vigorous physical activity (MVPA) threshold (Department of Health, n.d.), where subjects were categorized as “active” if they reached  $\geq 1260$  MET-minutes/week and as “inactive” if they were below that value. Television viewing/lying down duration was measured using a physical activity questionnaire that recorded the total time spent watching television or lying down in one day (P16 GPAQ). The measurement results were categorized based on Indonesian Minister of Health Regulation No. 41 of 2014 (Balanced Nutrition Guidelines: PMK No. 41 of 2014), which aligns with the 2020 WHO global recommendations (Warburton et al., 2023) into two groups: High Sedentary ( $> 2$  hours per day) and Low Sedentary ( $\leq 2$  hours per day). This limit was chosen because the Minister of Health Regulation recommends limiting sedentary activities to a maximum of 2 hours to maintain nutritional balance and health in school children.

Data analysis was conducted descriptively and inferentially using Microsoft Office software, Microsoft Excel, MSD Manuals clinical calculator (Calculator: Blood Pressure Percentile, 0 to 17 Years (2017 Standard) based on the AAP Clinical Practice Guideline 2017 (Flynn et al., 2017), and IBM SPSS Statistics version 27. Descriptive analysis was used to describe the characteristics of the subjects, growth status, blood pressure status, physical activity level and duration of watching television/lying down, which were presented in the form of frequency distribution tables and bar graphs.

Inferential analysis was conducted to examine the relationship between physical activity levels and blood pressure status and to examine the relationship between television viewing/lying down duration and blood pressure status using the Chi-Square ( $\chi^2$ ) test. This test was applied because the variables analyzed were categorical. Prior to testing, the data were tested for feasibility by observing the fulfillment of the Chi-Square test assumptions, including the

number of cells with an expected count  $\geq 5$ . All statistical tests were conducted with a significance level ( $\alpha$ ) of 0.05 and the results were declared statistically significant if the p-value  $< 0.05$ .

## Results and Discussion

The descriptive data analysis results in this study consisted of five components: physical activity level, TV viewing/lying down time, growth status, blood pressure, and the relationship between physical activity level and blood pressure, as well as the relationship between television viewing/lying down time and blood pressure. Each component was analyzed to provide a comprehensive picture of the students' condition. The data collected from all students will be described in detail in the following section:

### Physical Activity Levels of Female and Male Students

The detailed results of the descriptive analysis of the physical activity levels of female and male students are presented in the following table:

Table 2. Physical Activity Level Classification Method

Subject No.	Age	Gender	Age Group	MET y Code	MET y value	Daily Duration	Frequency	Total Duration	Total MET-minutes/week	Activity Status	Tv Watching Duration	Sedentary Category
1	11	female	10-12 Year	80320 x	3.9	15 Minute	7 Day	15x7 = 105 Minute	409,5	Light	8	High
2	8	female	6-9 Year	80300 x, 80320 x, 65300 x	4.6, 3.6, 8.2	11, 10, 120 Minute	7, 7, 1 Day	77+70+120 = 267 Minute	1590,2	Medium /Active	4	High
3	14	female	13-15 Year	80300 x, 80320 x, 65560 x, 25140 x	5.1, 4.2, 5.2, 5.8	35, 15, 180, 35 Minute	7, 7, 2, 2 Day	245+105+360+70 = 780 Minute	3968,5	Weight/Active	1	Low

Subject No.	Age	Gender	Age Group	MET y Code	ME Ty value	Daily Duration	Frequency	Total Duration	Total MET-minutes/week	Activity Status	TV WATCHING DURATION	Sedentary Category
1	6	Male	6-9 Year	80300 x, 80320 x	4.6, 3.6	20, 20 Minute	7, 7 Day	140+140 = 280 Minute	1148	Light	5	High
2	14	Male	13-15 Year	80320 x, 25140 x	4.2, 5.8	54, 90 Minute	7, 1 Day	378 + 90 = 468 Minute	2109,6	Medium /Active	10.2	High
3	17	Male	16-18 Year	80300 x, 80320 x, 65560 x, 25140 x	5.4, 4.4, 5.3, 6.4	30, 10, 30, 30 Minute	7, 3, 6, 7 Day	210+30+180+210 = 630 Minute	3564	Weight/Active	4.30	High

To determine the distribution of samples based on physical activity categories, the following frequency distribution table is presented:

Table 3. Physical Activity Levels of Female and Male Students

Gender	Category	6-9 Year	10-12 Year	13-15 Year	16-18 Year	Frequency	Percentage (%)
Female	Mild	0	9	18	0	27	25.7
	Moderate (Active)	1	3	2	0	6	5.73
	Heavy/Vigorous (Active)	0	1	6	0	7	6.66
Male	Mild	5	13	21	2	41	39.05
	Moderate (Active)	0	3	9	0	12	11.43
	Heavy/Vigorous (Active)	0	1	10	1	12	11.43
Total		6	30	66	3	105	100

Based on the frequency distribution in Table 3, the detailed results of the descriptive analysis of the physical activity levels of female and male students are presented in the following table:

Table 4. Descriptive Statistics of Physical Activity Levels of Female and Male Students

Category	Age	Gender	Mean±SD	Min	Max
Physical Activity	6-9 Year	Female Students	1590.2±0	1590,2	1590,2
		Male Students	850±214.32	574	1148
	10-12 Year	Female Students	852.015±1233.437	117	2901
		Male Students	935.29±946.46	117	3351
	13-15 Year	Female Students	1420.13±1253.27	174	6240
		Male Students	1723.21±1305.57	531	5826
	16-18 Year	Female Students	0/tidak ada	0	0
		Male Students	1683.33±1632.63	630	3564

Based on the descriptive statistical analysis results in Table 4, the average weekly physical activity load across all age groups met the MVPA threshold, reaching  $\geq 1260$  MET-minutes/week, which is in the moderate/active category. However, in terms of frequency, the majority of male and female students (64.7%) still fell into the light physical activity category, meaning they did not meet the MVPA threshold.

### Duration of Television Viewing/Lying Down for Female and Male Students

To determine the distribution of the sample based on the duration of television viewing/lying down, the following frequency distribution table is presented:

Table 5. Duration of Television Viewing/Lying Down for Female and Male Students

Category	Gender	Category	Frequency	Percentage (%)	Total
Duration of Television Viewing/Lying Down	Female Students	Low	4	10	40
		High	36	90	

	Male Students	Low	2	3.08	65
		High	63	96.92	
<b>Total</b>			105		105

Based on the frequency distribution in Table 5, the detailed results of the descriptive analysis of television viewing/lying down time for female and male students are presented in the following table:

Table 6. Descriptive Statistics of Television Viewing/Lying Down Time for Female and Male Students

Category	Gender	Mean±SD	Min	Max
Duration of Television Viewing/Lying Down	Female Students	6.07±2.555	1	10
	Male Students	5.80±2.271	1	10.3

Based on the results of the descriptive statistical analysis in Table 6, it is known that the majority of male and female students are on average in the high sedentary category, namely >2 hours/day, based on Indonesian Minister of Health Regulation No. 41 of 2014 and the WHO Global 2020. Meanwhile, in terms of frequency and duration of television viewing/lying down, the majority of male and female students are in the high category, meaning they are also in the high sedentary category.

### Blood Pressure of Female and Male Students

The detailed results of the descriptive analysis of female and male students' blood pressure are presented in the following table:

Table 7. Blood Pressure Classification Method

Subject No.	Age	Gender	TB (cm)	Z-score TB/U (WHO)	TB Percentile (P)	BP Measured 1	BP Measured 2	Average BP	P90 SBP Threshold (mmHg)	P95 SBP Threshold (mmHg)	Final BP Category
1	11.10	Female	150.2	0.75	P77.3	94/68	92/66	93/67	115	119	Normal
2	15	Female	150.4	-1.77		125/68	121/64	123/66			Increase
3	13.6	Female	145.2	-2.11		103/85	99/83	101/84			Hypertension Level 1
4	8	Female	150	3.5	P≥99.9	107/87	107/83	107/85	no results	no results	Hypertension Level 2
5	10.8	Female	138.4	-0.60	P27.4	108/94	106/90	107/92	112	115	Hypertension Level 2
6	6.8	Male	125.2	0.88	P81.1	90/70	88/65	89/67	109	113	Normal
7	15.5	Male	156.1	-1.96		123/70	119/64	121/67			Increase
8	15	Male	150.8	-2.28		113/84	111/80	112/82			Hypertension Level 1
9	6.9	Male	130.1	1.66	P95.2	102/87	100/90	101/88	110	114	Hypertension Level 2
10	6	Male	141	5.17	P≥99.9	95/65	85/65	90/65	no results	no results	Hypertension Level 2

Based on the blood pressure data in Table 7, the details of the growth classification and the results of the descriptive statistical analysis of blood pressure for female and male students are presented in the following table:

Table 8. Classification of Growth Status (Height/Age) by Gender

<b>Growth Status</b>	<b>Z-score criteria (TB/U)</b>	<b>Equivalent Percentile (P)</b>
Stunted	Z-score < -3 SD	< 0.13th P
Stunted	Z-score < -2 SD	< 2.3th P
Below Normal	-2 SD to -1 SD	2.3th P to 15.9th P
Normal	-1 SD to +1 SD	15.9th P to 84.1th P
Above Normal	+1 SD to +2 SD	84.1th P to 97.7th P
Tall	Z-score > +2 SD	> 97.7th P
Very Tall	Z-score $\geq$ +3.09 SD	$\geq$ 99.9th P

To determine the distribution of samples based on growth status classification, the following frequency distribution table is presented:

Table 9. Distribution of Height/Age Z-scores based on the 2007 WHO Basics of Blood Pressure Calculation

<b>Age</b>	<b>Gender</b>	<b>Category</b>	<b>Frequency</b>	<b>Percentage (%)</b>	<b>Total</b>
<b>&lt; 13 Year</b>	<b>Female</b>	Very Short	0	0	14
		Stunting	1	7.17	
		Below Normal	3	21.4	
		Normal	8	57.09	
		Above Normal	1	7.17	
		Tall	0	0	
		Very Tall	1	7.17	
<b>&lt; 13 Year</b>	<b>Male</b>	Very Short	0	0	22
		Stunting	0	0	
		Below Normal	2	9.10	
		Normal	16	72.8	
		Above Normal	1	4.50	
		Tall	1	4.50	
		Very Tall	2	9.10	
<b>&gt; 13 Year</b>	<b>Female</b>	Very Short	0	0	26
		Stunted/Stunting	3	11.5	
		Below Normal	13	50	
		Normal	10	38.5	
		Above Normal	0	0	
		Tall	0	0	
		Very Tall	0	0	
<b>&gt; 13 Year</b>	<b>Male</b>	Very Short	2	4.65	43

		Stunted/Stunting	6	13.95	
		Below Normal	17	39.5	
		Normal	18	41.90	
		Above Normal	0	0	
		High	0	0	
		Very High	0	0	
<b>Total</b>			105		105

The frequency distribution graph is shown as follows:

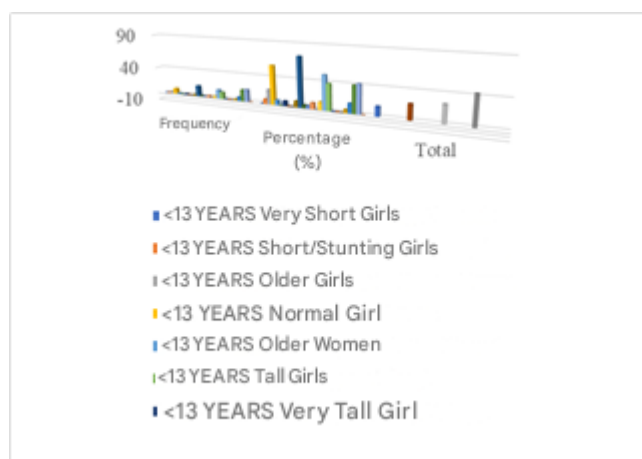


Figure 1. Frequency Distribution of TB/U Z-score based on WHO 2007 Basics of Blood Pressure Calculation

Based on the Height/Age Z-score distribution in Table 1, the detailed results of the descriptive analysis of blood pressure for female and male students are presented in the following table:

Table 10. Descriptive Statistics of Growth Status and Blood Pressure for Female and Male Students

Age	Gender	Category	Mean±SD	Min	Max
< 13 Year	Female Students	Z-SCORE	-0.29±1.464	-2.02	3.5
		Percentile	38.142±34.355	2.2	>99.9
	Male Students	Z-SCORE	0.54±1.573	-1.97	5.17
		Percentile	55.98±31.405	0.46	>99.9
> 13 Year	Female Students	Z-SCORE	-1.07±0.896	-2.5	0.94
		Blood Pressure	108/74±11.34/8.50	86/60	132/90
	Male Students	Z-SCORE	-1.26±1.009	-4.2	0.95
		Blood Pressure	107/67±12.01/11.02	81/35	147/87

To determine the distribution of samples based on blood pressure classification (normal, elevated, stage 1 hypertension, stage 2 hypertension), the following frequency distribution table is presented:

Table 11. Classification of Hypertension in Children According to the AAP, 2017

Category	Children <13 Years of Age	Children aged ≥13 - <18 years
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Normal Blood Pressure	Systolic and diastolic blood pressure <90th percentile	< 120/80 mmHg
Elevated Blood Pressure	Systolic and diastolic blood pressure $\geq$ 90th percentile to <95th percentile or 120/80 mmHg to <95th percentile	120/<80mmHg – 129/<80 mmHg
Stage 1 Hypertension	Systolic and diastolic blood pressure $\geq$ 95th percentile to <95th percentile + 12 mmHg or 130/80 to 139/89 mmHg	130/80 – 139/89 mmHg
Stage 2 Hypertension	Systolic and diastolic blood pressure $\geq$ 95th percentile + 12 mmHg or $\geq$ 140/90 mmHg	$\geq$ 140/90 mmHg

Based on Table 11, the blood pressure results obtained from the research sample were then categorized by age, height, and gender. The following is a table showing the frequency of blood pressure readings:

Table 12. Blood Pressure of Female and Male Students

Age	Gender	Category	Frequency	Percentage (%)	Total
< 13 Year	Female	Normal Blood Pressure	9	64.30	14
		Elevated Blood Pressure	0	0	
		Stage 1 Hypertension	3	21.5	
		Stage 2 Hypertension	2	14.2	
< 13 Year	Male	Normal Blood Pressure	16	72.7	22
		Elevated Blood Pressure	2	9.1	
		Stage 1 Hypertension	0	0	
		Stage 2 Hypertension	4	18.20	
> 13 Year	Female	Normal Blood Pressure	15	57.70	26
		Elevated Blood Pressure	2	7.70	
		Stage 1 Hypertension	8	30.8	
		Stage 2 Hypertension	1	3.8	
> 13 Year	Male	Normal Blood Pressure	38	88.40	43
		Elevated Blood Pressure	1	2.35	
		Stage 1 Hypertension	3	6.9	
		Stage 2 Hypertension	1	2.35	
<b>Total</b>			105	100	105

Based on the results of the descriptive statistical analysis in table 12, it is known that the average Z-SCORE/Growth Status of male and female students produces a balanced score, male and female students aged <13 years in the normal category (-0.29 and 0.54), while male and female students aged >13 years in the below normal category (-1.07 and -1.26). Followed by the results of the Percentile and Blood Pressure average (mean) of male and female students aged <13 years and >13 years produce a normal blood pressure category which means it meets the classification of hypertension in the normal blood pressure category. The frequency distribution graph is shown as follows:

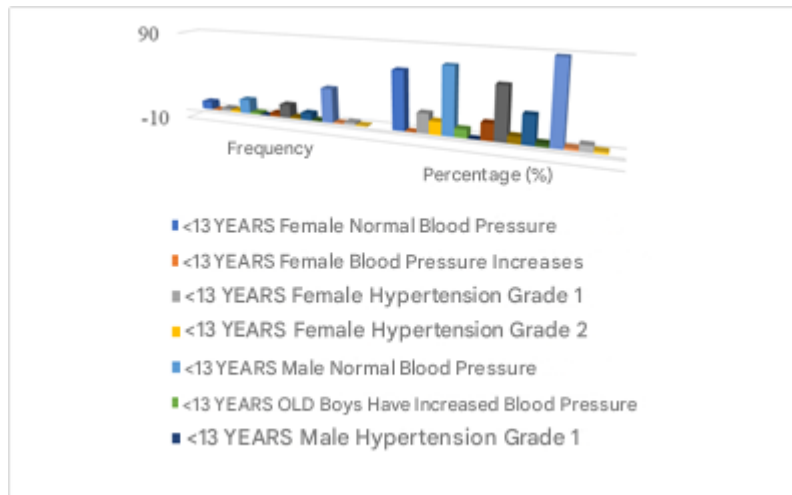


Figure 2. Frequency Distribution of Blood Pressure of Female Students & Male Students

### Chi Square Test Results for Female and Male Students

Based on the level of physical activity, duration of television viewing/lying down, and blood pressure of male and female students, the following correlations were found:

Table 13. Chi-Square Test Results for Physical Activity Level and Blood Pressure of Female and Male Students

		Blood pressure					P value
		Normal	Increase	Hypertension Level 1	Hypertension Level 2	Total	
Physical Activity Level	Light	51	4	7	6	68	0.814
	Moderate/Active	13	1	3	1	18	
	Heavy/Active	14	0	4	1	19	
Total		78	5	14	8	105	

Based on the duration of television viewing/lying down and blood pressure of male and female students, the following correlation was found:

Table 14. Chi-Square Test Results for Television Viewing/Lying Down and Blood Pressure of Female and Male Students

		Blood pressure					P value
		Normal	Increase	Hypertension Level 1	Hypertension Level 2	Total	
Sedentary	Low	2	0	2	2	6	0.027
	High	76	5	12	6	99	
Total		78	5	14	8	105	

Based on the chi-square test results in Table 14, it is known that the significance value for physical activity level and blood pressure is  $> 0.05$  with a result ( $p = 0.814$ ), which means there is no significant relationship. Meanwhile, in the previous table, it is known that the significance value for the duration of watching television/lying down and blood pressure is  $< 0.05$  with a result ( $p = 0.027$ ), which means there is a significant relationship.

The results of this study indicate a significant prevalence of hypertension (Levels 1 and 2) among school-age children in Mluweh Village, reaching 25% in the  $<13$  age group and 18.8% in the  $>13$  age group. These findings support various previous research reports in several regions of Indonesia, which consistently show childhood hypertension rates ranging from 14.8% to 49.5%. This high prevalence confirms that hypertension is no longer exclusively an adult disease but a real threat to children due to changes in modern lifestyles.

Inferential analysis in this study revealed no significant association between physical activity levels and blood pressure ( $p = 0.814$ ), possibly because the majority of respondents (64.7%) were in the light physical activity category and therefore did not meet the Moderate-to-Vigorous Physical Activity (MVPA) threshold of  $\geq 1260$  MET-minutes/week for cardiovascular protection. On the other hand, a significant relationship was found between sedentary behavior, in this case focused on the duration of television viewing, and children's blood pressure status ( $p = 0.027$ ), where the average sedentary duration exceeded the safe limit of 2 hours set by the Indonesian Minister of Health Regulation No. 41 of 2014 and WHO 2020. Physiologically, watching television is a unique sedentary activity because in addition to having very low energy expenditure ( $<1.5$  METy), this activity is often accompanied by a high-sodium and sugar snack diet that synergistically increases blood pressure. Although descriptively the average blood pressure of respondents is still normal, this statistical significance indicates that the duration of watching television/lying down alone is a strong enough predictor of increased blood pressure in children in Mluweh Village. This phenomenon is related to children's high cardiovascular compensation capacity, where the negative impact of sedentary duration has not reached the clinical threshold at the time of measurement, but is accumulative on arterial stiffness in the future. Furthermore, the use of the 2017 AAP standard based on height percentiles allowed this study to capture the often "hidden" trend of rising blood pressure. These findings serve as an early warning of long-term cardiovascular health threats due to impaired sympathetic nervous system regulation, even though current average values have not yet crossed the red line for clinical hypertension.

These findings underscore the urgency of early lifestyle interventions. Collaborative efforts between parents and schools are needed to limit screen time, particularly for children watching TV or lying down, to a maximum of two hours per day. Schools can integrate regular exercise programs and provide regular blood pressure monitoring facilities as early detection strategies.

This study has several limitations that should be considered. The Global Physical Activity Questionnaire (GPAQ) instrument was originally developed for adult populations. Therefore, although it has been modified and simplified for use with school-age children, there is still potential for reporting bias, particularly in younger respondents who have limited ability to estimate the duration, frequency, and intensity of physical activity. Therefore, the results of physical activity measurements in this study require careful interpretation. There is also a risk of METy calibration errors, despite the use of age-specific references. Furthermore, there is the possibility of misrepresentation of diurnal blood pressure variations due to static measurements, and the impact of gender imbalance (61.91% male) limits academic transparency regarding the generalizability of the results to a broader population.

## Conclusion

Researchers concluded that there was a statistically significant relationship between sedentary behavior, specifically watching television or lying down, and blood pressure levels in school-

aged children in Mluweh Village ( $p = 0.027$ ). However, no significant relationship was found between physical activity levels and blood pressure ( $p = 0.814$ ). The majority of male and female students reported high television viewing or lying down times (more than 2 hours per day), which has been clinically proven to contribute to the risk of hypertension.

### Recommendations

This study recommends that parents and educational institutions closely monitor and limit children's sedentary activities to no more than 2 hours per day. Healthcare workers at local community health centers should conduct routine blood pressure screenings adjusted to the child's height percentile (2017 AAP standards) as an early preventive measure for cardiovascular disease. Finally, future researchers are advised to use more objective physical activity measurement tools, such as accelerometers, to minimize self-report bias and consider nutritional intake variables, such as sodium consumption, which also plays a crucial role in blood pressure regulation.

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