

Original Article

Study of blood pressure in elementary school children at hill and seashore areas

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ABSTRACT

Background Measurement of blood pressure is the most important tool for early detection of hypertension. There is an assumption that salt consumption of the population living at the seashore is higher than that of those living on the hill area, and it would lead to higher blood pressure.

Objective To find out whether there is any difference of blood pressure between school-age children (6-13 years) living on the hill area (Brastagi subdistrict) and those living at the seashore area (Pantai Cermin sub district), North Sumatra.

Methods A cross sectional study was conducted in Brastagi and Pantai Cermin from September to October 1995. The subjects were taken by a simple random sampling method. The blood pressure was measured based on recommendation of The Second Task Force on Blood Pressure Control in Children 1987.

Results The means systolic pressure in boys of 6 years of age as well as in girls of 6,8,12 and 13 years, and the means of diastolic pressure in girls of 6,7,8,11 years were higher in Pantai Cermin ($p < 0.05$). Blood pressure had significant positive correlations ($p < 0.001$) with age, weight and height in both areas. Overall, hypertension was found in 117 (11%) out of 1065 children, 11.6% among girls and 10.6% among boys. On the hill and at seashore area, hypertension was found in 10.2% and 11.8% of children respectively, which was not statistically different ($p > 0.05$).

Conclusion In children, there was no significant difference between the prevalence of hypertension on hill and seashore area [*Paediatr Indones* 2003;43:6-9].

Keywords blood pressure, school-age children, hill, seashore, hypertension

Hypertension is an important problem in the health community since it has high prevalence,¹⁻³ and can cause early death, morbidity and sequels due to the complication in the brain, heart, kidneys and eyes.⁴⁻⁶ In adult population the prevalence is about 5-15%.³ Hypertension among adults is possibly acquired

since childhood and even since the infant periode.¹⁻⁷ Measurement of blood pressure is the most important tool for early detection of hypertension, but this procedure is usually missed as the part of routine physical examination in children. It should always be done routinely and continuously as the integral part of the child physical examination.⁸

Blood pressure in childhood and adolescence period is influenced by many factors, such as body weight, height, race, genetic, environment, age, and child's development.^{1,8,9} Other factors that might raise the blood pressure are high salt diet, stress, obesity, physical activity, and living habit.^{7,8,9-11} There is an assumption that salt consumption of the population living at the seashore is higher than that of those living on the hill area, and it would lead to higher blood pressure.¹²

We conducted a study on blood pressure measurement among elementary school students on the hill and seashore area to find out whether there is any difference of blood pressure between children living on hill and seashore area.

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Methods

A cross sectional study was conducted at Brastagi and Pantai Cermin sub district, North Sumatera Province, from September to October 1995. Brastagi is a highland area with minimum weather temperature of 15°C and maximum of 24°C, height of 1900 m above sea level. Pantai Cermin is a seashore area with minimum weather temperature of 22°C and maximum of 33.6°C, with height of 0-5 m above sea level.

The subjects were taken by simple random sampling method from all elementary schools in both areas. The inclusion criteria were elementary school children with age of 6 to 13 years whom on the physical examination were healthy, did not suffer from acute disease such as upper/lower respiratory tract infection, headache, chronic illness such as renal disease, hyperthyroidism, heart disease, and did not have any family history of hypertension, cardiovascular disease, and stroke.

One day before physical examination, every subject was asked to fulfill a questioner regarding personal data, age, and sex. Measurements of body weight (kg) and height (cm) were performed using a pair of scale of Detecto Medic. The blood pressure was measured using NOVA pressameter with appropriate cuff after a subject was in sitting position for at least 5-10 minutes. Korotkoff sounds were auscultated by Littman's pediatric stethoscope. The procedures of investigation process in this study were explained to every subject to avoid or minimize anxiety state. Measurement of blood pressure was done with a method recommended by The Second Task Force on Blood Pressure Control in Children 1987,¹³ by indirect auscultation, as follows: The subject was in sitting position and the upper arm was at the level of the heart. The cuff appropriately covered at least two-third of upper arm length. The membrane side of the stethoscope was then applied over the fossa cubiti. The investigator's eyes should be at the level of meniscus. The cuff was inflated to 20-30 mmHg above the point in which radial artery pulse was not palpable. The cuff was then deflated gradually at the rate of 2-3 mmHg/second until the first sound heard. This sound was considered as the first Korotkoff (Korotkoff I), which was identical with systolic blood pressure. The diastolic blood pressure was determined when the sound was abruptly soft (Korotkoff IV) for children of 3-12

year-old, and at the point of the sound was not heard (Korotkoff V) for children above 13 years of age. This measurement was taken in the morning at 09.00-12.00. All blood pressure measurements were grouped for age and sex, and then were analyzed to determine the 5th, 10th, 50th, 90th, and 95th percentiles. The criteria of childhood systemic hypertension in this study were defined as the value of systolic and/or diastolic blood pressure higher than 95th percentile for sex and age.

The data was analyzed by Microstat statistical program. The difference between two qualitative data was tested by chi-square test; the difference between two quantitative data was tested by hypothesis test for mean; the correlation between two quantitative data was tested by Pearson's correlation, and p value <0.05 was considered significant.

Results

Five hundreds and fifty-nine children from Brastagi and 528 children from Pantai Cermin were formerly recruited in this study. Ten and 12 children from Brastagi and Pantai Cermin, respectively were excluded since they had history of hypertension. The rests were 549 children from Brastagi and 516 from Pantai Cermin, consisted of 531 boys and 534 girls.

The mean systolic pressure of boys in Pantai Cermin was higher compared to that of in Brastagi, but the difference was not statistically significant, except in the group of 6 years of age (93.5 vs. 91.03; $p = 0.04$). The mean diastolic pressure of boys in Pantai Cermin was also higher than that of in Brastagi, but this difference was also not significant. Moreover, the mean systolic pressure of the girls in Pantai Cermin was higher compared to that of in Brastagi but the difference was not statistically significant except in the group of 6 (97.0 vs. 91.1; $p < 0.001$), 8 (105.5 vs. 96.9; $p < 0.001$), 12 (113.9 vs. 107.3; $p = 0.005$), and 13 years of age (114.5 vs. 108.0; $p = 0.02$). The mean diastolic pressure of the girls in Pantai Cermin was higher than that of in Brastagi as well, but was not significant statistically; while in the group of 6, 7, 8 and 11 years of age this differences were statistically significant [64.3 vs. 57.8 ($p < 0.001$); 73.2 vs. 66.0 ($p < 0.001$); 71.7 vs. 66.5 ($p < 0.001$); 70.7 vs. 68.0 ($p = 0.03$) respectively]. The girls of 6 years of age in

TABLE 1. THE DISTRIBUTION OF HYPERTENSION

	Brastagi		Pantai Cermin	
	Boys	Girls	Boys	Girls
Total number	281	268	250	266
No. of hypertension	25 (8.9%)	31 (11.6%)	30 (12%)	31 (11.6%)
Type of hypertension				
- Systolic	9 (36%)	13 (41.6%)	8 (26.7%)	13 (41.9%)
- Diastolic	9 (36%)	9 (29%)	13 (43.3%)	14 (45.2%)
- Systolic & Diastolic	7 (28%)	9 (29%)	9 (30%)	4 (12.9%)

Pantai Cermin were significantly taller compared to those living in Brastagi (109.1 vs. 105.6; $p=0.002$). The significant difference of blood pressure measurement in this group of age may be due to the significant difference of the body height (data not shown).

There was no significant difference in body weight between boys who were living in Brastagi and those living in Pantai Cermin, whereas mean body weight among girls aged 7, 9 and 10 years in Brastagi were significantly higher than that of in Pantai Cermin [19.0 vs. 17.8 ($p=0.009$); 26.0 vs. 23.9 ($p=0.002$); 25.5 vs. 24.4 ($p=0.02$) respectively]. On the other hand, there was no significant difference in height between boys living in Brastagi compared to those living in Pantai Cermin, except in the age group of 10 (127.3 vs. 125.5 cm; $p=0.02$) and 11 (130.6 vs. 128.0 cm; $p=0.02$) years that were higher in Brastagi (data are not shown).

There was a positive correlation between age and blood pressure measurement; the older the children, the higher the blood pressure measurement ($p < 0.001$). The correlation of age with systolic blood pressure ($r=0.53$ in boys, and $r=0.58$ in girls) was higher than that with diastolic blood pressure ($r=0.42$ in boys and $r=0.37$ in girls). This study also found the correlation between body weight and blood pressure; the heavier the children, the higher the blood pressure ($p < 0.001$). The correlation of body weight with systolic blood pressure ($r=0.55$ in boys and $r=0.51$ in girls) was higher than that with diastolic blood pressure for both sexes ($r=0.41$ in boys and $r=0.37$ in girls).

A positive correlation was also found between age or body height and blood pressure, the taller the children the higher the blood pressure ($p < 0.001$). The correlation of body height with systolic blood pressure ($r=0.55$ in boys and $r=0.55$ in girls) was higher

than that with diastolic blood pressure ($r=0.40$ in boys and $r=0.44$ in girls).

From 1065 children in both areas, hypertension was found in 117 children (11%). Hypertension was found more among girls, where 62 out of 534 (11.6%) girls had hypertension compared to 55 out of 531 (10.4%) among boys. Hypertension was found more in the Pantai Cermin where 61 out of 516 (11.8%) children had hypertension, compared to 56 out of 490 (10.2%) children in Brastagi, but this difference was not statistically significant. On the hill area, 25 out of 281 (8.9%) boys and 31 out of 268 (11.6%) girls were suffering from hypertension. Based on the type of hypertension, it was found that 9 boys (36%) and 13 girls (41.9%) were systolic type while diastolic type was found in 9 boys (36%) and 9 girls (29%). Systolic and diastolic hypertension was found in 7 boys (28%) and 9 girls (29%). (Table 2) At the seashore area, hypertension was found in 30 out of 250 (12%) boys and 31 out of 266 (11.6%) girls. Eight boys (26.7%) and 13 girls (41.9%) had systolic hypertension; while diastolic hypertension was found in 13 (43.3%) boys and 14 (45.2%) girls, whereas 9 (30%) boys and 4 (13%) girls suffered from systolic and diastolic hypertension (Table 1).

Discussion

From the observation of the blood pressure measurements in elementary school age children, it was found that the increasing of either systolic or diastolic blood pressures occurred as the increasing of age,⁹ and there were positive correlations between age, body weight and height with blood pressure. In this study, by using the 95 percentile as the highest border of the normal blood pressure value in children,

hypertension was found among 117 children of 1065 children (11 %). The prevalence of hypertension was higher in girls than boys (11.8% vs. 10.4%). This prevalence is higher than that of the previous studies.¹⁴⁻²⁰

This study found that the mean blood pressure of children in Pantai Cermin was higher than that of children in Brastagi. The prevalence of hypertension in Pantai Cermin was higher compared to that in Brastagi even though the difference was not significant statistically.

Wahab found the prevalence of hypertension was higher in children who were living at the seashore area compared to that of children in the other areas that were far away from the seashore, even though the difference was also not significant statistically.

In conclusion, there was no significant difference between the prevalence of hypertension in children living in Brastagi (hill area) and Pantai Cermin (seashore area).

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