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Studies of Blood Pressure in Primary School Children in a Rural Area in Indonesia[1)]

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ABSTRAK

A. Samik Wahab — *Tekanan darah pada anak sekolah dasar di daerah pedesaan Indonesia*

Telah diukur tekanan darah pada 506 anak sekolah yang berumur antara 6—14 tahun dan terdiri atas 227 anak laki-laki dan 279 anak wanita. Sampel ini diambil secara *cluster* dan acak dari suatu populasi anak sekolah di pedesaan. Tekanan darah ini diukur pada anak sekolah dari 17 sekolah dasar kecamatan Sewon, Bantul, Daerah Istimewa Yogyakarta. 17 sekolah ini merupakan sampel dari seluruh sekolah dasar yang ada di kecamatan Sewon.

Alat yang dipakai untuk mengukur adalah sphygmomanometer bahan air raksa, dan pengukuran dilakukan oleh hanya satu orang. Semua anak mula-mula diukur tekanan darahnya pada posisi duduk, kemudian pada posisi telentang.

Hasilnya pada posisi duduk tekanan darah sistolik berbeda secara bermakna antara anak laki-laki dan wanita, kecuali pada anak umur 6 tahun. Demikian juga tekanan darah diastolik, kecuali pada anak umur 14 tahun.

Tekanan darah pada posisi duduk dan tidur berbeda bermakna baik pada laki-laki maupun pada wanita.

Key Words: blood pressure — rural primary school children — systolic pressure — diastolic pressure — hypertension

In Indonesia there are relatively little data available in the pediatric literature regarding the level of arterial blood pressure in children.

In developed countries, however, many extensive blood pressure studies have been published, particulary in the USA. Yet there are very great differences in the average values observed in the various studies even in studies from the same geographical region (Kaas Ibsen, 1981). Many reasons may be suggested for these differences, including differences in selecting the material, conditions of investigation, apparatus and cuffs, observer variation and position of subjects.

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The purpose of this study was two-fold: *first,* to obtain data regarding the distribution of blood pressure levels in different age groups in children in a rural area in Indonesia; and *second,* to determine the incidence of hypertension in this population.

MATERIAL AND METHOD

Children attending the elementary school in the District of Sewon, Bantul, Province of Yogyakarta, located about 15 kilometers from the centre of the town of Yogyakarta, were included in the survey. 506 out of 7000 children from 35 elementary schools were selected as the sample.

The selection of the subjects was made as follows: seventeen elementary schools were picked at random from a list containing all the schools in the District of Sewon. Pupils attending these schools are, by and large, from families with a rural background. Further selection of the subjects from each school was made through a purely random selection of 4—5 pupils from each grade. The subjects ranged in age from 6 to 14 years and consisted of 227 boys and 279 girls.

Blood pressure was recorded on the right arm by the same investigator, after a 5-minute resting period, first in the sitting position and then in the supine position. If the child had just attended gymnastics, blood pressure measurement was postponed. Before each registered blood pressure measurement, a pilot measurement was made to reassure the child. A standard mercury sphygmomanometer "Erkameter" was utilized.

The width of the inflatable cuff employed corresponded to 2/3 of the length of the upper arm, as measured by the distance between the acromion and the olecranon. The length of the inflatable cuff was long enough to encircle the limb completely or nearly completely.

Korotkoff's first phase is registered as the measurement of the systolic blood pressure. Koretkoff's fifth phase is regarded as the level of the diastolic pressure.

The mercury column was pumped up to 10 mm Hg above the systolic pressure and then allowed to fall at the rate of 2 mm per pulse beat.

Sounds were registered by means of a stethoscope placed in the anticubital fossa.

RESULTS

Data for systolic blood pressure measured in the sitting position for the various ages and sex groups are shown in TABLE 1. In all age groups except the 6 years age-group there was a statistically significant difference in systolic BP between the sexes. From the age of 7 through the age of 13 the mean systolic BP of females was higher, though at the age of 14 the mean systolic BP of males was higher ($p < 0.05$; $p < 0.01$; $p < 0.001$).

TABLE 2 shows the results of the diastolic component. In all age groups except the 14 years age-group there was a statistically significant difference in diastolic BP between the sexes. The mean diastolic BP was higher in female subjects

TABLE 1. — Mean and SD values of systolic blood pressure in the sitting position, distributed by age group and sex.

Age in Years	Males (N: 227)			Females (N: 279)		
	Number	Range	$\bar{X}$ + SD	Number	Range	$\bar{X}$ + SD
6	12	92—116	107.7 ± 7.9	8	84—120	108.7 ± 12.2[a]
7	28	85—120	110 ± 10.4	35	90—120	111.5 ± 7.9[b]
8	22	90—120	107.9 ± 9.6	34	90—120	110.9 ± 8.7[c]
9	32	94—128	110.6 ± 8.9	34	90—128	114.4 ± 9.4[c]
10	26	98—128	112.8 ± 8.2	42	100—124	116.6 ± 6.7[c]
11	28	100—130	114.6 ± 7.3	36	90—138	114.8 ± 9.2[a]
12	27	96—126	114.2 ± 9.7	40	98—140	117.6 ± 8.8[c]
13	36	96—130	116.5 ± 8.1	28	108—130	119.9 ± 6.2[c]
14	16	114—130	120 ± 4.1	12	110—138	119.3 ± 8.5[b]

[a] $p > 0.05$ [b] $p < 0.01$ [c] $p < 0.001$

TABLE 2. — Mean and SD values of diastolic blood pressure in the sitting position, distributed by age group and sex.

Age in Years	Males (N: 227)			Females (N: 279)		
	Number	Range	$\bar{X}$ + SD	Number	Range	$\bar{X}$ + SD
6	12	60—80	73.2 ± 8.8	18	50—82	69.9 ± 9.8[b]
7	28	55—88	73.5 ± 8.7	35	60—82	74.4 ± 7[b]
8	22	60—80	71.2 ± 8.1	34	60—86	73.4 ± 7.7[d]
9	32	50—90	71.9 ± 8.3	34	80—90	73.2 ± 12.2[c]
10	26	60—82	74.5 ± 6.9	42	60—88	75.6 ± 6.5[d]
11	28	60—80	75.5 ± 5.3	36	50—84	73.9 ± 8.5[d]
12	27	60—86	74.7 ± 6.4	40	60—90	78.3 ± 6.7[d]
13	36	60—90	74.2 ± 7.3	28	62—90	80 ± 6.7[d]
14	16	70—90	80 ± 5.2	12	70—90	80 ± 6[a]

[a] $p > 0.05$ [b] $p < 0.05$ [c] $p < 0.01$ [d] $p < 0.001$

TABLE 3. — Mean and SD values of systolic blood pressure in the supine position, distributed by age group and sex.

Age in Years	Males (N: 227)			Females (N: 279)		
	Number	Range	$\bar{X}$ + SD	Number	Range	$\bar{X}$ + SD
6	12	96—120	112.5 ± 8.4	18	88—126	115.5 ± 10.4[b]
7	28	86—120	110.9 ± 9.9	35	90—124	116.2 ± 6.9[c]
8	22	92—124	111.1 ± 8.1	34	98—124	116.4 ± 6.9[c]
9	32	90—128	112.4 ± 8.8	34	94—128	115.1 ± 9.5[c]
10	26	100—130	116.7 ± 6.6	42	96—130	118 ± 6.5[c]
11	28	90—136	116.4 ± 8.8	36	80—140	118 ± 8.7[a]
12	27	100—134	117.1 ± 8.8	40	100—144	121.8 ± 8.4[c]
13	36	100—130	117.6 ± 7.8	28	110—132	122.8 ± 6.5[c]
14	16	110—130	121.6 ± 6.2	12	104—140	122.4 ± 10.5[b]

[a] $p > 0.05$ [b] $p < 0.01$ [c] $p < 0.001$

with the exception of the 6 and 11 years age-groups, in which the mean diastolic BP of males was higher.

TABLE 4.— Mean and SD values of diastolic blood pressure in the supine position, distributed by age group and sex.

Age in Years	Males (N: 227)			Females (N: 279)		
	Number	Range	$\bar{X}$ + SD	Number	Range	$\bar{X}$ + SD
6	12	60—78	69 ±4.9	18	50—80	67.7± 9.4[a]
7	28	50—84	69.1±9.4	35	50—84	72.1± 9.3[b]
8	22	56—80	70.6±7.5	34	60—84	73.8± 6.2[b]
9	32	50—86	67.9±8.4	34	50—90	72 ±10.4[b]
10	26	60—84	73.1±6.7	42	60—84	75.1± 5.7[b]
11	28	60—90	72.1±7.7	36	54—86	73.7± 7.5[b]
12	27	60—90	73.6±7.9	40	58—90	77.7± 8.4[b]
13	36	60—80	70.8±7.5	26	60—90	77.6± 8.3[b]
14	16	60—86	74.9±7	12	70—90	79.5± 5[b]

[a] $p > 0.05$ [b] $p < 0.001$

The data in the supine position are shown in TABLE 3 for the systolic BP and TABLE 4 for the diastolic BP.

In all age groups except the 14 years group there was a statistically significant difference in systolic BP between the sexes, with the female mean systolic BP higher than that of the male ($p > 0.05$; $p < 0.01$; $p < 0.001$).

With the exception of the 6 years age-group, a statistically significant difference in diastolic BP was also found in all age groups, with mean diastolic BP higher than that of the female ($p > 0.05$; $p < 0.01$; $p < 0.001$).

ELEVATED BLOOD PRESSURE

Six male subjects out of 227 (2.6%) had blood pressure levels which exceeded the 95th percentile and were considered as definitely hypertensive. In the female group, 8 subjects out of 279 (3.8%) had elevated blood pressure levels, *i. e.* levels above the 95th percentile. Four of the 6 male subjects had systolic hypertension only, one subject diastolic only and one subject systolic and diastolic elevation of blood pressure. Six of the 8 female subjects had systolic hypertension only, and 2 diastolic elevation only. Among 277 male subjects, 4 (1.8%) had systolic pressure levels between the 90th—95th percentiles and 7 (2.5%) out of 279 female subjects had systolic pressure levels between the 90th—95th percentiles for their respective age groups. These groups were suspected of hypertension.

The data above concerning elevated blood pressure are based on the sitting position measurement. Blood pressure in the supine position is not analyzed here because WHO recommended utilizing the sitting position.

TABLE 5.— Incidence and types of hypertension in children aged 6 to 14 years.

	Males	Females
Total number studied	227	279
Number and percentage with hypertension	6 (2.64%)	8 (3.86%)
Number and percentage with:		
systolic hypertension	4 (66.6 %)	6 (75 %)
diastolic hypertension	1 (16.6 %)	2 (25 %)
systolic and diastolic hypertension	1 (16.6 %)	—
Number and percentage of suspect hypertensive subjects	4 (1.76%)	7 (2.5 %)

DISCUSSION

The threshold for hypertension recommended by WHO is 160/95 mm Hg, while blood pressure in the range 140—160/90—95 has been termed borderline hypertension. The definition of hypertension in adult life is relatively definite, whereas opinions concerning what should be understood as hypertension in childhood are much more varied. One of the main reasons for this disagreement is that blood pressure is not constant throughout childhood, but rather generally increases gradually with age (Kaas Ibsen, 1981).

It is generally acknowledged that the determination of blood pressure in children is often neglected as a necessary component of the physical examination. This is due to, *first,* the difficulities related to accurate measurement, *second,* the notion that idiopathic hypertension does not constitute a problem in childhood, and *third,* the lack of established normal values in different age groups for comparison (Cassimos *et al.*, 1977).

In Indonesia there are few studies currently available concerning blood pressure in children. However, studies concerning blood pressure in adults and adolescents have been published everywhere, and the incidence of hypertension in adults in Indonesia has been found to range between 0.65—19.5% depending on location (Boedhidarmojo, 1977; Gunawan *et al.*, 1978).

The reasons for investigation of childhood hypertension have been uncommon in Indonesia because it is not easy to define hypertension in childhood, and because the sequelae of high blood pressure such as stroke and cardiovascular morbidity, are not seen at this stage of life. Several authors have used the 90th or 95th percentile to define hypertension (Cassimos *et al.*, 1977; Loggie, 1977; Wilton, 1983).

In my study, a significant difference was found between the blood pressure measured in the sitting and in the supine position, both in boys and in girls. In general, mean systolic blood pressure measured in the supine position was significantly higher than in the sitting position. The mean diastolic blood pressure, however, measured in the sitting position was significantly higher than that in the supine position. The explanation might be that the position of the heart is different in these two different positions (FIGURE 1).

Kaas Ibsen (1981) found in children that there was a significant difference between the blood pressures measured before and after blood was drawn for testing. The systolic and diastolic pressures were lower after blood sampling. This might be because children were nervous before sampling.

The results illustrate the necessity of measuring blood pressure under conditions as standardized as possible, with regard to such variables as the physical position and the mental states of the child.

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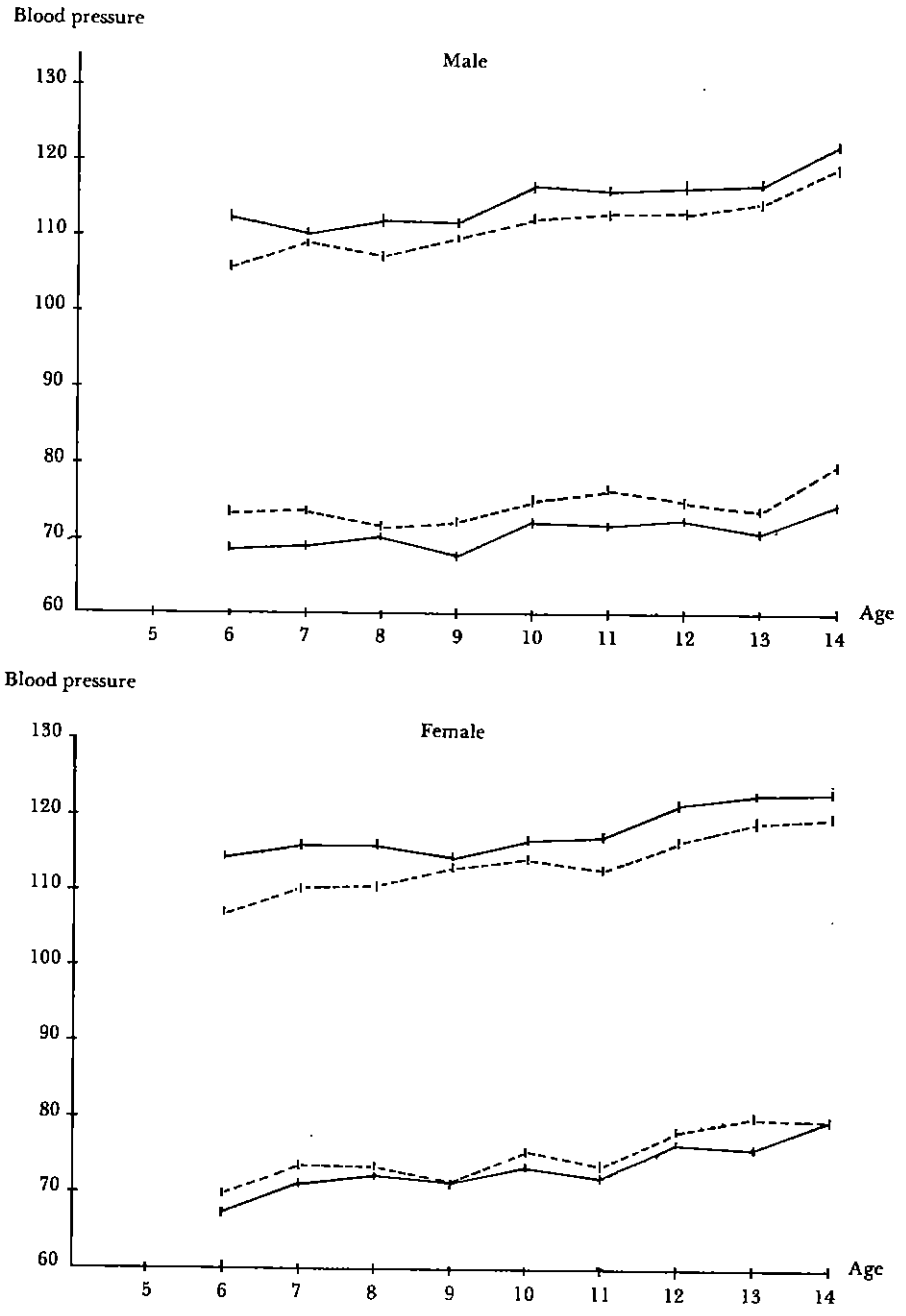

FIGURE 1.— The results of the blood pressure measurements in both sexes, obtained in the sitting and in the supine positions.

———: Systolic and diastolic blood pressure in the supine position.

– – – –: Systolic and diastolic blood pressure in the sitting position.

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